WILD FLOWERS AS THEY GROW

Photographed in Colour direct from Nature

BY H. ESSENHIGH CORKE, F.R.P.S.

With descriptive text by

G. CLARKE NUTTALL, B.Sc.

Susan
from Grandmama
Easter Day
1944 -

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1 LESSER CELANDINE

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CONTENTS

	PAGE
Bee Orchis	192
Bindweed	166
Bird's-foot Trefoil	66
Black Knapweed	122
Dandelion	112
Dog Rose	41
Dog Violet	32
Field Poppy	24
Foxglove	129
Hairbell	183
Lesser Celandine	1
Meadow Crane's-bill	97
Monkshood	15
Musk Mallow	59
Ox-eye Daisy	104
Primrose	152
Red Clover	75
Rose-bay Willow Herb	89

Contents

PAGE

Scarlet Pimpernel 174
Thrift 159
Toad-flax 137
Tufted Vetch 82
White Dead Nettle 144
Wild Strawberry 50
Wood Anemone 9

LIST OF PLATES

Lesser Celandine	*Frontispiece*
	FACING PAGE
Wood Anemone	10
Monkshood	16
Field Poppy	24
Dog Violet	32
Dog Rose	42
Wild Strawberry	50
Musk Mallow	60
Bird's-foot Trefoil	66
Red Clover	76
Tufted Vetch	82
Rose-bay Willow Herb	90
Meadow Crane's-bill	98
Ox-eye Daisy	104
Dandelion	112
Black Knapweed	122
Foxglove	129
Toad-flax	138

List of Plates

FACING PAGE

White Dead Nettle 144
Primrose 152
Thrift 159
Bindweed 166
Scarlet Pimpernel 174
Hairbell 183
Bee Orchis 192

WILD FLOWERS AS THEY GROW

THE LESSER CELANDINE

RANUNCULUS FICARIA

THE Lesser Celandine is the earliest of spring flowers, and its golden, starry blooms break the dreariness of the woodlands even before the

a, calyx. *b*, petals. *c*, stamen. *d*, fruit. *e*, receptacle, bearing carpels.

winter is well over. "Herald of a mighty band, of a joyous train ensuing," it therefore makes a special appeal to our affections, and Wordsworth

has given voice to this in his well-known poem on the Celandine, beginning :—

> "Pansies, lilies, kingcups, daisies,
> Let them live upon their praises,
> There's a flower that shall be mine—
> 'Tis the little celandine.
> Ere a leaf is on a bush,
> In the time before the thrush
> Has a thought about its nest,
> Thou wilt come with half a call,
> Spreading out thy glossy breast
> Like a careless prodigal,
> Telling tales about the sun,
> When we've little warmth or none."

The dark, glossy leaves—the first ones are heart-shaped, the later ones lobed somewhat like the ivy—only precede the flowers by a few days, and the shining of the leaves and the burnishing of the golden petals give a triumphant appearance to its uprising. Months before the plant had prepared for this early awakening, for in the previous year, when its day was over, all the nutriment of any sort that lay in leaves and stalks was slowly withdrawn and placed in fibres of the root, which swelled and

bulged with their store. The part of the plant above-ground withered and died in the early summer days, but the tubers below lay primed and waiting. If now the plant had been dug up and washed, they would have been seen hanging in a bunch, a dozen or more together, looking like so many little figs—hence the plant's specific name, "ficaria," from *ficus*, a fig, and its corresponding English name of Figwort.

All summer and autumn the tubers lay quiescent, but directly the depth of the winter had passed the plant revived, and all necessary materials being at hand, leaves and flowers were quickly pushed upwards. Now no doubt this very early appearance of the Celandine has been evolved as a measure of self-preservation. A small plant, growing in the damp earth under the shadow of trees, it would have had little chance in the struggle for existence when the foliage was out and endless other plants were competing for a place. But by appearing in these very early days, it has the field practically to

itself and can flourish in freedom. It is curious to see how the change in the initial arrangements has worked out in other respects. Originally, no doubt, the flower was intended for warmer, later days—it is supposed to be one of the most ancient plants we have—and its flowers were evidently developed with a view to attract and utilise insects in their fertilisation, they are so gorgeous in colour, so brilliant in texture, their tiny honey sacs lie so ready to hand on the bases of their petals, their stamens contain pollen and their stigmas wait expectantly for it. But as they come so soon in the year, few of the insects have by then emerged, for the flowers can face colder days than the insects can, and the result is that comparatively few of the flowers are fertilised. A few, but only a few, seeds are produced as a rule, not enough in the plant's estimation to risk posterity upon, so it has recourse to another and quite different method of reproducing itself which is independent of all external aid.

If we carefully examine the points where the stalks of the upper leaves join the stem, we shall see at each a curious little object like a very minute rounded tumour, which grows until it is about the size of a wheat grain. In the early summer days when the leaves and stems are yellowing and dying, these become loose and finally drop to the ground, and are lost sight of. But each is capable of producing a new plant, and will do so if conditions are favourable. A heavy rain will sometimes wash them from the plants in every direction, and Kerner tells us that "a sudden downpour of rain in a region abundantly overgrown with Lesser Celandine is sufficient to float away numbers of the tubers, and heap them up on the borders of irrigation channels when the rain disperses. In such places the quantity of tubers which have floated together is often so large that one can hardly gather them in one's hands. In this way arose the idea that the tubers had fallen from heaven with the rain and the myth of a rain of potatoes." This, too, no

doubt, accounts also for the mysterious "rains of wheat" that are sometimes vouched for by peasants in various parts. It is an extraordinary instance of the carefulness of Nature that these bulbils are only produced in abundance on those plants where the fruits have failed to set.

When we examine the flowers in more detail we find that the sepals and petals are all alike coloured on their faces—though green on their backs—and that their number is variable, ranging from seven or eight to a dozen or more. Wordsworth fancifully suggests that when a painter first attempted to portray the rising sun he took the idea of the radiating pointed rays from a glance at the Celandine's "glittering countenance." Directly the flowers close they sink into inconspicuousness because of the green backs to the coloured rays. There are a number of rather fragile stamens, and the fruits, of which there are many, are dry and distinct and form a globular head, one head from each flower.

The leaves were once boiled and eaten, but their

flavour is not to be recommended. The great botanist Linnæus advised all farmers to get rid of this plant from their land because it was disliked and not eaten by the cattle, and because, too, he thought it had an injurious influence on other herbs in the meadows. Happily his advice was not followed, for though it is true most plants of this family have bitter or disagreeable juices in their tissues the Celandine is an exception. Ranunculus —the generic name of this plant—alludes to the damp and marshy localities preferred by the plants of the family, *Rana* being "a little frog"—whose native haunts agree with those of this group of plants. Its old English name of Pilewort is due to the fact that it was considered a safe cure for hæmorrhoids (or piles) the reason for this resting on the very unsafe ground that the fibres of the roots had the same appearance as this disease. Nicholas Culpepper, writing two hundred and fifty years ago, assures us that: "It is certain by good experience, that the decoction of the leaves and

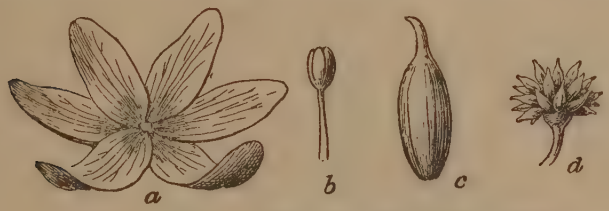
roots doth wonderfully help piles and hæmorrhoids; Also kernells by the ears and throat, called the King's Evil, or any other hard wens or tumours," and he goes on further to assert the astounding fact that "The very herb borne about one's body next the skin helps in such diseases though it never touch the place grieved."

The Lesser Celandine is a perennial, and its seedlings do not flower the first year of their lives, but collect and store up material to start their accustomed course in the ensuing winter days.

THE WOOD ANEMONE

ANEMONE NEMOROSA

GREEK tradition tell us that Anemos, the Wind, sends his namesakes, the Anemones, in the earliest spring days as the heralds of his coming, and so they are called by us the "Wind



a, sepals. *b*, stamen. *c*, fruit. *d*, receptacle, bearing carpels.

Flowers." Pliny affirmed that they are only open when the wind blows, and generations of poets have sung of

> "Coy anemone that ne'er uncloses
> Her lips until they're blown on by the wind."

However that may be, it is in the most blustering days of spring, in March and early April, that the fragile Anemone, hung on the most slender and pliable of stems, yields to and yet withstands the rough buffetings of the wind. Nothing seems to daunt it, and it is one of the first to lift its head above the dead leaves in the wood. Its delicate stems, bearing the deeply cut leaves and the star-like white flowers, have a strong anchor in a tough rootstock which runs horizontally just beneath the ground. It is the quick growth of this rootstock that causes the plant to spread so rapidly and to form its colonies in the moist soil of wood and thicket. The leaves and flowers rise directly from it on separate and unbranched stems; the flower-stalks are, however, adorned some little distance below the flower with three leaf-like appendages—they are often so deeply divided that they appear more than three in number—and they doubtless are of use in keeping small insects from attacking the blossoms. At the outset they serve to wrap up

2 WOOD ANEMONE

the flower-bud and protect it in the bitter weather, but as the bud opens its stalk lengthens and it is carried high above them.

The chief characteristic of the flower is that there are no true petals, the plant has entirely dispensed with them, for the sepals have taken on the petals' rôle, and become white and altogether attractive. There is no honey and but little scent, and though bees and other insects occasionally visit it and suck the juices out of its tender white sepals, yet it does not seem to make use of them or depend on them in any way, and as its many stamens and carpels ripen together they no doubt fertilise among themselves. Perhaps the plant is quite satisfied with an accidental cross-fertilisation secured occasionally. The numerous carpels, each quite distinct from any other and each containing a single seed, are bunched together in the centre of the flower, and make an admirable alighting place for such insects as do come. Eventually they are transformed into small, downy, dry fruits.

As night approaches the Anemone flower bows its graceful head so that the dews of night may not settle on it and injure it; and if rain threaten in the daytime it does the same, and so receives the drops upon its back whence they trickle off harmlessly from the sepal tips.

Though the sepals are pure white on their faces they are usually slightly flushed with colour at their backs, and it is perhaps this pink tinge which has caused the Anemone to be considered the emblem of sickness. The Egyptians, for instance, held it as such, while the Chinese call it the "Flower of Death." In some European countries the peasants look upon it as a flower of ill-omen though it is difficult to understand how this superstition arose. The Romans, however, picked the first Anemones as a charm against fever, and this practice still survives in some remote places where a sure remedy is considered to be provided by gathering an Anemone and saying, "I gather this against all diseases," and then tying it round some invalid's neck!

The plant itself seems to be peculiarly liable to attack from certain fungi; thus at times a *Puccinia* settles upon it, with the result that the stalks of the infected leaves grow rapidly and tower above their fellows, though the leaves themselves dwindle and lose their divisions. Another fungus, a *Sclerotinia*, does much more harm, for it makes its home in the swollen tubers of the roots, and then, when the spring-time comes and the pretty nodding flowers should appear, there comes up instead only a wretched changeling, the ugly fructifications of the fungus.

Out of the many charming legends that have gathered round the Anemone place must be given to one which describes Venus wandering through the woodlands, weeping for the death of her lover Adonis.

> "Tears plenteous as his blood she pours amain
> But gentle flowers are born and bloom around
> From every drop that falls upon the ground;
> Where streams his blood there blushing springs a rose;
> And where a tear has dropped, a wind-flower blows."

The only other Anemone native to this country is the Pasque Flower (*Anemone pulsatilla*), which is quite distinct, and bears flowers of a dull, purplish colour.

THE MONKSHOOD

ACONITUM NAPELLUS

A SINISTER reputation has always hung over the Monkshood, and the striking, uncommon appearance of the flower but accentuates it. For it is a poison plant, one of the most virulent we

a, sepals. *a'*, sepals separated. *b*, stamen. *c*, stamens and carpel. *d*, fruit.

know, and from the earliest days all manner of lurid legends have gathered around it. Down in the ground its thick root stores up rich reserves of food materials for future use, but it stores up also with

them a most potent poison, and many a fatality has arisen from mistaking the root for horseradish, to which it bears a strong resemblance. Thus in Ireland a poor woman sprinkled powdered aconite root over a dish of greens, and one man was killed and another seriously affected by partaking of it. The field mice are well aware of its evil nature, and in hard times, when they will attack almost any plant that offers them food, they leave this one severely alone however pressed they may be. Aconite, however, is a very useful medicine when given in small and proper doses, and makes up into a valuable liniment when used in moderation. The stem and leaves of the Monkshood also are poisonous though in a lesser degree. It is very curious how animals seem instinctively to shun these leaves, though apparently they have no smell of any sort to serve as a warning. In the Alps one may see bushes of these plants growing with the greatest freedom, though surrounded on all sides by grazing animals. Perhaps there is some

3 MONKSHOOD

slight odour undistinguished by us but which is distinct enough to them. A story is vouched for that a doctor, anxious to reassure a patient who had inadvertently eaten some of the leaves, himself ate several asserting they were not poisonous, and shortly after died in great agony.

But poisonous though the plant is, it does not deserve all the countryside traditions of evil repute, such as that smelling the flowers is injurious, that children should not be allowed to play in its vicinity because of its bad effects, and so forth. These are exaggerations founded on ignorance.

A reference to its nature is implied in one of its names—"Wolf's-bane"—for our ancestors are said to have discovered that arrows tipped with aconite were particularly efficacious in dealing with wild animals—the wolf in particular—and this name comes to us from a very distant past. The Monkshood is particularly rich in synonyms each of which calls attention to some particular aspect of the plant. Thus it is known as "Blue Rocket,"

from its spike of blue flowers that stands up so bravely, and "Bearsfoot" because its much-divided leaves offer a fanciful resemblance to the paw of a bear. The quaint appearance of its flowers, each with its large hooded sepal—it is the sepals, not the petals, that are coloured—is responsible for various other names—"Monkshood" among them. Thus it is known as "Friar's Cap" and "Pope's Ode" (*i.e.* Hood); as "Helmet Flower" and "Grannie's Night Cap"; and in Scotland as "Auld Wife's Huid," "Old Wives' Murches," and "Luckie's Mutch." Now if this large purple sepal be drawn back a little two shining black objects—the nectaries—can be seen within it, so "Face-in-Hood" is yet another countryside name; if the hood be still further drawn back these two objects spring forward quickly on long stalks, and the children have thought of them as two little people coming out of their house, and they call the plant "Adam and Eve," or "Noah's Ark," for, they say, "this is Noah and his wife."

Again, if the hood be taken completely away and the rest of the flower left intact and the stalk then turned round through a right angle, a most charming and dainty little object stands before us, on account of which the plant is called variously "Venus's-Chariot-Drawn-by-Two-Doves" (sometimes shortened to "Venus's Doves"), or again, "Chariot-and-Horses," or again, "Jacob's Chariot" (though why Jacob is not clear), the two nectaries being the doves or horses, their stalks the shafts, and the remaining petals a fairy chariot.

With regard to its Latin name, *Aconitum napellus*, the *napellus* signifies a little turnip, and refers to the swollen part at the base of the stem.

When we come to look at the flower from a more serious point of view, we realise at once that it has been very specially adapted to some purpose, and that purpose, we discover, is to attract and utilise bee visitors. The sepals, usually green, are here purple—purple being especially attractive to bees—and fancifully shaped. The petals are only

now represented by the two very curious stalked nectaries within the hood; the stamens are many in number and lie depressed in a bunch at the mouth of the flower, and in the centre of the stamens is a tuft of carpels within each of which is an immature seed. The stamens have their pollen ready quite early in the plant's life, and one by one they rise up, pour it out so that it falls on to the lower sepals, and then lie back again curled up out of the way, their work done. It is the carpels' turn next, and their tops grow a little taller, and now everything is ready, and only awaits the hoped-for visitor. If he comes on from another Monkshood flower his abdomen is coated with pollen, and as he clings to the stigma for support while he probes upwards to the honey sacs, he rubs some of it off on to them. At the same time, as he moves in the flower, he cannot fail to collect on his abdomen some of the loose pollen that is lying in his very path, so he flies away with honey for himself and pollen for a neighbouring blossom.

The Monkshood

It is an interesting amusement to watch a bee visiting the Monkshood. He plunges up through the two lower side petals and makes straight for the nectaries in the hood, his body almost completely lost in the flower. There is a moment's quietude as he draws down the honey through his proboscis, and then out he backs, and on he goes to another flower. If the flower has been already drained of honey he does not waste his time but goes in, reconnoitres, and comes out immediately. A very curious adaptation of the flower was lately seen by the writer. An ordinary spike has the flowers on short stalks all standing upright and parallel to the stalk. One such stalk, however, got bent over into a horizontal position, and each little flower promptly adjusted itself to the new condition and twisted through a right angle, so that it again became upright for the bees to visit it. The horizontal stem with the quaint Monkshood flowers at right angles to it reminded one of sparrows on a telegraph wire.

We can see how carefully the loose pollen is

protected from rain by the over-arching side petals. If we pull out the stamens one by one (they slip out easily), we shall see that, though small, they are of very unusual form, for their thin blue filaments have a white miniature leaf attached below. These leaf-like appendages, though well known on leaves—for example, at the base of rose leaves—are very rare indeed on stamens. Along the filaments by aid of a glass we can detect minute hairs.

As the flowers fade and die the carpels in the centre grow larger and larger, each one distinct from its fellows, and the fruit is ultimately seen as a ball of small dry pods, in each of which is a single seed.

Now, in spite of these elaborate plans, it cannot be said that the Monkshood makes much headway in increasing its numbers on the face of the earth. It is comparatively rare as a wild plant in Great Britain, though found widely cultivated in gardens. It prefers shady, moist places, chiefly in the mountainous districts in Western England and Wales.

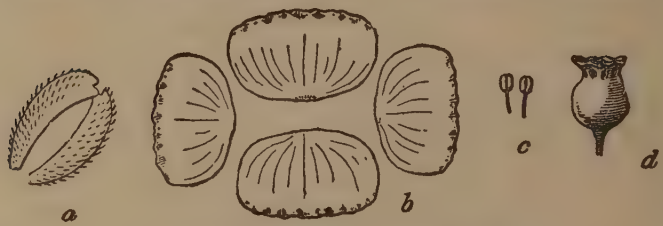
The fact is, it risks everything on the visits of one single insect—the bee—and when matters are so highly specialised as this, it is not to be wondered at that there is often the proverbial "slip 'twixt cup and lip." We find throughout the whole plant kingdom, as, indeed, we find in our own society, that it is the simpler plans and the more independent individuals that are the most successful in "inheriting the earth."

There are one or two interesting points to be noticed in the germination of the little seeds of the Monkshood. In the first year only the seed-leaves appear—there are no proper foliage shoots, and, of course, no flowers or fruit. Then, again, the little root making its way downwards tugs so hard that the point where the stem arose is dragged quite a distance below the surface—say a couple of inches. Thus the plant becomes firmly established for years to come, being a perennial.

THE FIELD POPPY

PAPAVER RHÆAS

THE Field Poppy is the only scarlet flower that we have in the whole British flora. The little Scarlet Pimpernel, in spite of its name, is brick-red



a, sepals. *b*, petals. *c*, stamen. *d*, fruit.

rather than scarlet, and in any case is the only rival for a claim to this colour.

The Poppies as a class are poorly represented in Britain. Beside the common Field Poppy there are only the Long-headed Poppy (*Papaver dubium*), a

4 FIELD POPPY

mere variety of it, the Rough Poppy (*Papaver hybridum*), and the Pale Poppy (*Papaver argemone*), and the last two are rarely to be met with. There are also three yellow Poppies: the Horned Poppy, so characteristic of our sea-coasts, the Welsh Poppy, loving the hills, and the Greater Celandine (*Chelidonium majus*); but these we must place in a different class from the Red Poppies, as they have many distinctive marks. The Opium Poppy (*Papaver somniferum*) is not a native of our country, but it has escaped from cultivation, and now grows wild in various places. It has a white and purple flower. All the Poppies contain a copious supply of thick juice; in the Red Poppy it is milky white, in the Yellow Poppy it is yellow. This juice oozes out from cut stems and leaves, but it is specially abundant in the Poppy heads or seed-capsules. In the case of the Opium Poppy it forms the base of the familiar narcotic.

The Field Poppy, the subject of our illustration, is best known to us in the cornfields

"'Neath the blue of the sky, in the green of the corn,
It is there that the regal red poppies are born."

But we also find it at home on railway embankments, and here and there by the wayside; while it is one of those plants that appreciates a cranny in an old wall, making a patch of brilliant colour high above the ground.

All sorts of names have the country folk given to the Poppy; it owes "Corn Rose," "Cop Rose," "Red Weed," "Red Cap," and "Fireflout" to its colour, and "Soldiers" too, the name dating back to long before khaki days; "Cheesebowl" is due to its shape, and "Headaches" to its heavy odour.

"Corn poppies that in crimson dwell,
Called headaches from their sickly smell."

says the poet Clare. Gerard speaks of it as "Joan Silver Pin," the reason for which is doubtful, but may not it be from the appearance of its seed capsules? When standing ripe in the sunshine, each has very much the look of a long silver pin with a globular head. Sometimes, too, it has been known

as "Thunder Flower" or "Lightning Flower," from a very curious superstition among children that if they pick it and the petals fall off, as they are apt to do, the children are then liable to be struck by lightning. As for the name Poppy itself, no one can suggest its origin. It comes to us from Anglo-Saxon days, when the plant was called Po-pig. The common idea that both it and the Latin generic name, *Papaver*, refer to the children's "pap" (presumably containing some soothing agent) is too far-fetched. Its specific name, *rhæus*, means a pomegranate, because its seed capsule resembles that fruit.

The plant stands about one to two feet high and is covered with roughish hairs. The leaves are much divided into segments.

The flower-buds hang their heads droopingly in early days, and the scarlet petals are crumpled up untidily within two rough, thick, pimpled sepals. When the flower bud is about to burst it raises itself erect, the sepals break apart and promptly

fall off. The four petals smooth out their creases, and stretch themselves to form the characteristic scarlet cup. Often they are marked with a dark eye by their base that shows up their rich colouring still more brilliantly. Round the centre of the cup is a ring of many purple stamens, and in the heart of the flower is an urn-shaped receptacle for the ovules with a lid-like stigma beautifully marked by radiating lines.

Now the Poppy does not lay itself out for any special visitors in the way that the monkshood, foxglove, and dead nettle do. Its hospitality is extended to bees, flies, and beetles indiscriminately. Further, gay and alluring as it is, it provides no honey; nevertheless, its insect visitors do not go away hungry and unsatisfied, for the stamens shed their pollen into the cup, and there it lies while the petals remain, and as many an insect feeds largely upon pollen they find in this flower a veritable feast. One wonders if they also find a soothing, narcotic influence in it! If one looks carefully

at any of these pollen grains under a microscope, one sees that each is a little ball always marked by three grooves running like meridians of longitude from pole to pole. But though the flies, beetles, and bees of all sorts dine on the pollen, they do not eat it nearly all, and they carry away on their legs and bodies quite sufficient to fertilise the next flower they visit. The flat top of the urn furnishes a delightfully convenient resting-place for their alighting, and, by the way, it is always ready to receive pollen a few hours before the stamens round it shed theirs, so during these few hours there is more than a chance of its being fertilised from some other flower. After this short time, fertilisation may as easily take place from its own pollen as from that of a neighbouring flower.

When both petals and stamens have gone—the stamens are apt to remain the longer—the urn grows larger and larger, its lid still pressed tightly down upon it. If one cuts it through at this stage it is seen to be divided up into as many compartments

as there are rays on its lid—perhaps a dozen or so—and in each compartment are very many small seeds, so that altogether there are hundreds in each capsule. As it grows the stigma lifts itself up all round at the edge and stands out like a frill, forming a perfectly flat star-rayed plate. As it approaches maturity it becomes dry, the dividing walls within shrivel away, and the seeds fall to the bottom. We can plainly hear them rattle if we shake it.

Now at the top of each capsule, right under the edge of the lifted lid, a number of holes appear, one for each compartment, like unglazed windows. But at first sight it seems rather remarkable that if they are intended for the escape of the seeds they should be at the top of an upright capsule, while the seeds are lying at the bottom. Yet this is actually part of the plant's scheme for the best dispersal of its seeds, in spite of its appearing to be quite the wrong way about, for when the air is still they lie safely at the bottom. But when a strong breeze comes and the long stems sway vigorously to and

fro, then the tiny light seeds are jerked out through the holes a few at a time, and the impetus thus given means that they are thrown some little distance away—the distance varying according to the strength of the wind from just below the parent plant to perhaps yards away. Thus they are scattered over a comparatively wide area, instead of falling out in heaps at the foot of the plant and crowding one another to death, as they would have done had the holes been at the bottom instead of at the top.

According to mythological lore, the Poppy owes its existence to the goddess of corn, Ceres. Proserpine, the daughter of Ceres, had been carried off by Pluto, and her mother wandered on the earth sadly seeking her, and it was then—

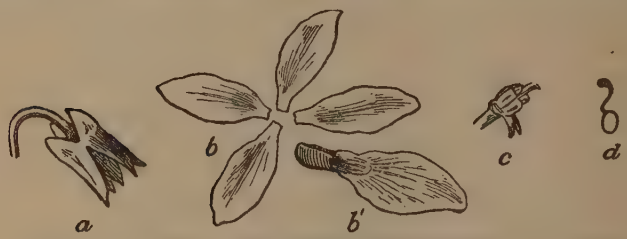
> "She bade the poppy rise,
> Not merely gay the sight to please,
> But blessed with power mankind to ease
> And close the aching eyes."

So naturally, says legend, we find the Poppy still in company with the corn.

THE DOG VIOLET

VIOLA CANINA

THE Violet is the most cunning of plants. From beginning to end, every stage in its life is distinguished by clever contrivances and



a, calyx. *b*, *b′*, petals. *c*, stamens surrounding ovary. *d*, ovary with style and stigma.

deep-laid plans. Indeed, it seems as though it were sometimes "too clever by half," and after much elaboration of detail it has perforce to return to simpler ways to accomplish its ends.

At the outset its leaves enter upon the stage of

5 DOG VIOLET

life after a most neat and dainty fashion. At first each appears rolled up into two tight coils, lying side by side at the end of the stalk. As the days pass the rolls uncurl and move apart and eventually the whole face of the leaf lies spread out before us. It is an interesting fact that in the Violet the young leaves are rolled up from each side into the middle on the *face* of the leaf; in the primrose, its spring companion, they are rolled up similarly, but on the *back* of the leaf.

Then its flower is a model of ingenuity, and well repays careful examination. Let us take one to pieces and examine it bit by bit, but first notice how the stem bends and the flowers droop so that no rain can enter to hurt them. Next notice the five green sepals. Though they are small they each have a pointed green ear or "auricle," which projects backwards up the stem, and the five ears together form a little wall which rings the stem and which serves precisely the purpose that an orchard wall does—namely, to keep out thieves and

all intruders. The would-be thieves in this case are little insects that creep up the low stem and would gladly poach the honey and the pollen if they could. But when they have laboriously reached the summit of the stem their further progress into the "land of delight" is prevented by this same green wall. The Violet, like the orchard owner, is going to protect its treasures if it can.

The pale, purple petals then claim our attention. There are again five of them, two smaller ones on top, two larger ones as wings, and one, largest of all, which is intended to serve as an alighting platform for insect visitors. This large petal has a long and deep pouch attached to it, and, moreover, is marked by streaks and lines which point in the direction of the mouth of this pouch. When we pull off carefully the petals one by one, we soon arrive at the purpose of this pouch, for when all have gone there is left a quaint yellow object at the top of the flower stalk. It is made up of five yellow stamens with big heads and no stalks,

and two of these stamens are distinguished by having long humps or spurs running out from their backs. At the very tip of each of these spurs is a sac full of honey, so sweet that one can taste it if one puts it to one's mouth, and as the spurs run down into the petal pouch the sacs are tucked away in its very depths.

Now, since the heads of the stamens touch one another and they stand in a ring, they form the walls of a chamber down the very middle of which runs a column. Such a curious column, too, as we can see if we move one or two stamens to make a peephole. It hangs from a green ball, which we know is the case of unripe and unfertilised seeds, and it has a "kink" in the middle of it, while its end, which passes out beyond the stamen tips, has a peculiar bird-like knob upon it. In fact, this knob forms the floor of the chamber.

What, then, is the rationale of this elaborate arrangement?

Very shortly after the flower has opened the

anthers of each stamen split on their inner side and pour their contents of yellow pollen dust into the chamber, where it lies quite securely protected. Presently, if all goes well and as the flower designs —a big "if" this—a bee will come along looking for honey. He alights on the big petal platform, and, guided by the lines upon it which plainly tell him, "This way to the nectar," he thrusts his proboscis down the pouch and sucks at the honey sacs that he finds at the bottom. As he does this his head perforce knocks on the column knob—the stigma. Probably he has just come from another violet flower, in which case he has already a dusty head, and so he unwittingly smears the knob, as he presses it, with this dust. But this is not all; at his knock the kink in the column "gives," the floor of the chamber is pushed back, and out falls the pollen in a tiny golden shower and adds fresh dust on his head. However, he flies away, quite happy with the honey he has secured, and not at all troubled about his dusty head. That all this that I have

written occurs if a bee comes can be easily shown by putting a dusty blunt pencil where the bee would touch. It will both smear the knob and open the pollen chamber.

Now it is really sad that such an elaborately designed plan should not usually succeed, but the fact remains. The bees that the Violet invites with so many allurements rarely seem to respond. The truth is that the Violet arranges for bee visitors and then blooms before it is really bee time—a slight oversight on the part of the plant—and rare indeed is it to find a Violet flower setting seed. Sometimes, however, the stock is strengthened by a cross-fertilisation, and possibly this occasional fulfilment really satisfies the actual needs of the plant.

Directly the season for flowering is over the plant sets to work to repair omissions, and it produces down among the leaves, quite out of sight, things which are the merest apologies for flowers, which have no petals, no scent, no honey, and

which never open to the light of day. To look at, they are like flowers which have aborted instead of developing, but within each one are a couple of stamens and some unripe seeds. The pollen of these stamens touches the seeds-to-be, and soon the miserable specimen of a flower is changed into a fat, healthy capsule full of seeds. Here, at any rate, simplicity of method achieves what elaboration could not.

These seed-capsules of the Violet also exhibit another phase of the plant's cleverness. When they are ripe they split into three parts, each fitted with a row of black, bead-like seeds. As the walls dry they contract, and thus the seeds are pinched out one by one, sometimes being shot a yard or two away from the parent plant. Thus the Violet does what it can to give its young ones some chance in their start in life by scattering them afield.

The Dog Violet is said to be so called because it disappoints by having no scent, the term "dog" being here one of contempt. In other respects it

surpasses the Sweet Violet, beloved of poets, for it is larger and flowers for a longer period. Indeed, it is the Violet best known to us from the fact that it lifts its pale, purple head above the leaves, and so can be easily seen; while the Scented Violet usually keeps its darker flowers hidden among its foliage, thus earning the repute of modesty. There are four other kinds of Violet belonging to this country, all very similar to the Dog Violet with the exception of the Heartsease—*Viola tricolor*. The Dog Violet can be found from April to July in woods and hedgerows, flowering away gaily long after its sweet-scented sister has ceased. At one time a medicine made from it had some reputation in curing skin diseases.

The Violet is an old English flower and there are few poets indeed who have not sung its charms.

An old legend tells us that when the great god Jupiter changed his beloved Io into a white heifer for fear of Juno's jealousy, he also caused Violets to spring from the earth to be fitting food

for her. Shakespeare probably had this story in mind when he says of Ophelia:

> "lay her in the earth,
> And from her fair and unpolluted flesh
> May violets spring."

The Violet was once the badge of a political party. When the great Napoleon went as a prisoner to Elba his last message to his adherents was that he should return with the Violets, so he was always alluded to and toasted by them in secret as Caporal Violette—"the flower that returns with the spring"—and the Violet was adopted as the badge of the Imperial party.

THE DOG ROSE

ROSA CANINA

THE Dog Rose stands unrivalled as Queen of Beauty among our English wild flowers, and the delicacy of its loveliness is enhanced by its fleetingness, for each flower has a bare two-days'

a, calyx. *b*, petals. *c*, stamen. *d*, fruit. *e*, receptacle, with stamen and carpels.

life before it when its buds open, and the whole of its "season" is comprised in a scant three weeks. "The wild rose never outstays St. Mary Magdalen" used to run the legend of the country-

side, and this is very fairly true, for July 22nd —her day—usually sees the last of them.

Two explanations have been put forward for its name of Dog Rose. The first and most generally accepted is founded on an ancient tradition that the root would cure a bite from a mad dog, but the second and more probable is that originally it was called the Dag Rose—"dag" being a dagger—because of its great thorns, and like the "Dog-wood" (really Dagwood) became changed into "Dog" by people who did not understand the allusion. These thorns, by the way, are a very valuable asset to the plant, for not only do they serve as a great protection from foes without, but they also help it to climb, preventing it losing its hold and slipping back as it clambers over the hedges.

Not only is the flower beautiful, it is also interesting. It is one of those flowers where the end of the flower stalk grows up round the central carpels and encloses the little fruits as in a case,

DOG ROSE

and when we turn back a flower we can see the case beneath it. On the top of the case are borne five sharply pointed green sepals, sometimes themselves bearing pointed teeth, and five pink and white petals. Within the petals are many delicate yellow stamens all spreading outwards from a tiny green tuft in the centre. If now we cut open the flower we find a number of white, hairy objects, the fruits-to-be, and the tuft in the centre was made up of the tops—or stigmas—of these. Now the flower throughout is obviously of great fragility and little fitted to withstand rough usage, so the petals do what they can to guard it by folding over the stamens when rain comes. Moreover, for the one night which each Wild Rose has to face in its short life they also close as a precaution. It awakes, however, almost before the sun, and opens out to greet his first rays so that this night-closing of the Rose is apt to pass unnoticed. It is true an open Rose will often be found in the hours of darkness, but these are Roses whose life is over, whose

pollen is gone, whose seeds are fertilised, and whom the rain and dew can no longer harm.

Now we know that the Dog Rose carries no honey, but it is so fragrant and attractive that it manages to secure plenty of insect visitors, particularly small flies and beetles, who alight on the central grey tuft and who feed on the pollen and transfer it at the same time from stamens to stigmas both within the same bloom, and from flower to flower, and thus fertilisation is secured. And now begins an unusual thing, for the receptacle round the fruits grows gradually luscious and red, and forms the "hip" so well known to us. *We* call the hip the fruit of the Rose, but botanists call it a false fruit, because it is really the stalk-end that forms it; the *real* fruits, each containing one seed, are the little hairy objects within it. These hips are undoubtedly baits for birds, and much appreciated by them. The lesser birds pick at them and scatter the seed round about, but the large birds, like the blackbirds, thrushes, and jackdaws,

swallow them whole. The outer part is digested and serves as food, while the seeds pass through the intestines unharmed, their hairiness probably facilitating this, and are dropped, perhaps, far away from their native bush. Thus over the whole country the Dog Rose finds a home. Mice and others of their kind would dearly love to share with the birds, and they gnaw the hips with avidity if they are placed on the ground, but the plant has no use for these little animals, and securely guards against their depredations with its thorns, for no mouse, however daring, could pass those terrible downward-pointing prickles that lie along the stem. Everyone has heard of the saying that connects a large number of hips and haws in the autumn with a severe ensuing winter on the ground that the Almighty sends them as a special provision for the birds—even the wise Lord Bacon endorsed it; but it is more than doubtful whether this abundance can be regarded as a true prophecy.

These hips now left by us contemptuously as fit only for the birds have a pleasant acid flavour, and once were greatly esteemed. Gerard, writing in the earlier part of the seventeenth century, said of the Rose, "The fruit when it is ripe makest most pleasant meates and banketting dishes as tartes and such like." Another old writer says, "Children with great delight eat the berries thereof when they are ripe, and make chaines and other pretty geegaws of the fruit; cookes and gentlewomen make tarts and suchlike dishes for pleasure." But the fact is the silky bristling covering of the seeds is unpleasant and apt to set up irritation of the throat. Hence in these days of fruit wealth we can afford to leave the hips to the birds. They can cause irritation of the skin, too, as many a schoolboy knows to his cost when one of his schoolmates has pushed a handful inside his collar.

Chemists make a conserve of roses by beating up the pulp with white sugar, and use it in conjunction with other drugs, while in Russia and

Sweden a kind of wine is made by fermenting the fruit. Our ancestors had great faith in a conserve of rose for cooling the "heate of the eye." The scent of this rose is very characteristic. It is remarkable how very distinctive the scents of the different species of roses are, so much so that a blind person can distinguish between them on this ground alone.

The Wild Roses are the ancestors of all the endless glorious varieties of cultivated roses that we know, and to this day rose-growers welcome as important any variation in a Wild Rose, because from it they may be able, by using it in crossing, to produce some new variety. (In the cultivated roses the stamens have left their original work of producing pollen and become changed into petals, and hence these flowers can never reproduce themselves by seed.) Quite a number of new varieties are produced each year, and form the features of the great rose shows. The French growers are especially skilful in this direction. The work of crossing

roses and producing new species was well known to the Romans, and the Japanese and Chinese gardeners have probably practised it from even earlier ages still. In an Austrian garden a rose grower has recently collected no fewer than 4,200 different kinds, and still many are lacking. Of course, new species, when once created, can be propagated by cuttings, buddings, and graftings; but to produce a new species one must always go back to the simple rose with stamens and seeds.

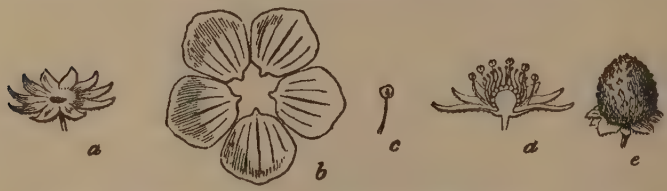
Another old country name of the Dog Rose is the "Canker Rose," no doubt alluding to the fact that galls with moss-like coverings frequently are found upon them. These are known as bedeguars, or by the country folk as "Robins' Cushions," though the robin has nothing to do with them beyond the fact that both have some red about them. They are, in fact, caused by a wasp—the rose-gall—which punctures a leaf while it is yet undeveloped in the bud, and there lays its eggs. Immediately the normal growth of the leaf alters, and numerous

larvæ are formed. The larvæ hatch out and creep further into the leaf tissues, until the whole swells into the gall we know in which there are as many chambers as there are larvæ to inhabit them. All sorts of virtues have been attributed to these curious objects; they are said to produce sleep if placed under the pillow at night, and their astringency caused them once to be much used in old-fashioned medicine.

THE WILD STRAWBERRY

FRAGARIA VESCA

"DOUBTLESS God could have made a better berry, but doubtless He never did," says wise old Izaak Walton of the Wild Strawberry, and there is a common consensus of opinion that it is



a, calyx. *b*, petals. *c*, stamen. *d*, sections through flower. *e*, "fruit."

our choicest native fruit. Connoisseurs even say that the finest specimen of cultivated Strawberry cannot surpass it in flavour. All through the centuries of Britain's development it seems to have been appreciated. Our Anglo-Saxon forefathers knew it

WILD STRAWBERRY

as the Streowberie—the berry which spreads or scatters (as we say to "strew" or "straw" the ground), referring to the growth of the plant, which throws off "runners" and covers the ground with them. The common idea that the name is given because one places straw under the cultivated plants when the berries are ripening is quite erroneous. The name is far older than the custom. In 1265 the "straberry" is mentioned in the household roll of the Countess of Leicester, and Holinshed, writing in the sixteenth century of the Duke of Gloucester, afterwards Richard the Third, tells us that in 1483 as certain great lords were sitting in council arranging his coronation the duke came in, and, "saluting them courteouslie, said to the Bishop of Ely, 'My Lord, you have verie good strawberries in your garden in Holbonne; I require you to let me have a messe of them." Shakespeare in slight paraphrase also introduces this remark in his *Richard the Third.*

But as a rule Strawberries were not cultivated

until later. The wild fruit grew in such abundance in the woods that the roots of the trees were "powdered" with them, an old writer says; and these little berries served all purposes, and were gathered and brought into the markets to be sold as they are to this day in Italy. In the reign of Henry the Eighth their price was fourpence a bushel, and much earlier than that we hear of them among the London "cries."

> "My son hath sent you
> A pot of strawberries gathered in the wood
> To mingle with your cream,"

says one in a play by Ben Jonson about 1603. Tusser, who wrote "Advice to a Farmer" in Henry the Eighth's reign, says for September work:

> "Wife, into the garden and set me a plot
> With strawberry roots of the best to be got,
> Such growing abroad among thorns in the wood,
> Well chosen and picked prove excellent good,"

which shows that even when Strawberries were grown in gardens it was the *wild* ones that were placed there.

The Wild Strawberry

It is a curious fact that the botanist considers the Strawberry a "false fruit"; the true fruits, he says, are the little hard yellow bodies that lie scattered over its fleshy surface. The reason for this statement we shall see when we watch a flower change into its fruit.

The delicate little white flower of the Strawberry is known to us all. There is an outer cup of five green sepals; then five white regular petals arranged star-like. Round a little green mound in the centre are numerous fragile stamens, and on the mound are many tiny green bodies—the carpels—each containing a seed. The flower, indeed, is of similar pattern to that of the rose, but with this notable difference: the centre of the rose is a hollow *in* which the carpels lie, the centre of the Strawberry is a mound *on* which they lie, the depression in the one case and the mound in the other being the end of the flower stalk.

The flower is visited by insects and generally fertilised by them. As a special precaution, each

flower is ready to receive pollen before it is ready to supply it; thus it is usually fertilised from another flower before its own pollen is ready. The honey with which it allures insects is contained in fleshy tissue that lies around the central mound. Now in the rose we saw that after the flower was over the cup-like end of the stalk became juicy and red, and grew so that it completely enclosed the little dry fruits within it, and thus the hip—a false fruit—was formed; in the Strawberry, again, the end of the stalk grows and becomes juicy and red, but here it is a mound, so it carries out the real little fruits on its surface instead of enclosing them, and again we have a false fruit. Thus the rose and the Strawberry are inversions one of the other. In both the birds pick out the luscious false fruit and scatter in various ways the true fruits in all directions.

But in spite of all these elaborate and apparently successful plans for propagating itself, the Strawberry has yet another scheme for ensuring its exist-

ence and multiplying its species. This is its production of "runners" which rise off the central stock of the plant, long thread-like stems with buds at wide irregular intervals. From each of these buds an offshoot springs which takes root and eventually becomes a new plant. The connecting thread-like stem dies away when the daughter plant is established. What a great power of increase this is can be judged from the following. "A Strawberry stock sent out three runners during the summer; each took root at five nodes, and from each node a bud—*i.e.* offshoot—developed, so that the following year the mother stock was surrounded by fifteen daughter plants. Next summer," continues Kerner, "fifteen new offshoots were again formed from each of the original fifteen, arranged in exactly the same way; and in the forest glade, where three years previously there had been only a single Strawberry plant occupying a space of 50 sq. c.m., there would now be 200 plants distributed over a space of about 3,600 sq. c.m." The better establishment

of these daughter plants in the soil is facilitated by a curious power the roots have of pulling the nodes down into the ground as they grow out of them. This is due to the roots being definitely sensitive to the action of gravity, and so directing their tips towards the centre of the earth. Hence, if the Strawberry once becomes established in a suitable home, it will flourish in great abundance.

The compound leaves, with their handsome toothed edgings and their clothing of silky hairs, are well worth watching as they unfold. In the bud the half of each of the three leaflets is folded in fan-like pleatings, and the two halves, with the midrib as hinge, touch each other. Moreover, the three leaflets really lie one on the other, and the whole bud is a downy little object. As growth progresses the leaflets move apart, their halves open slowly, the pleatings smooth out, until ultimately the full grown leaf with its central terminal leaflet and its two lateral ones spreads out before us, but the parallel veining running from midrib to

margin is always reminiscent of the fan pleats of its youth.

A pastime among country folks, dating from far back centuries, is that of threading the little crimson fruit on a slender grass stem and forming bracelets, which were exchanged as gifts between lovers.

Eating this fruit in sufficient quantities has been considered as a panacea for all the ills that flesh is heir to. Linnæus particularly enjoyed Wild Strawberries and believed they cured his gout, while others have taken them for fevers, bilious disorders, etc. Doubtless they are among the most wholesome of fruit. Their pleasant characteristic odour is responsible for the botanical name of this plant, *Fragaria*, derived from the Latin *fragrans*, fragrant.

The Strawberry plant is a perennial, and its flowers, appearing first in May, can be found throughout the whole summer. Thus flowers and mature fruit are often seen together. A variety of the Wild Strawberry, known as the Hautboy Straw-

berry, is sometimes discovered. It has a musky scent, and the flowers have the peculiarity of being either male or female—*i.e.* containing either stamens or carpels, but not both. Thus cross-fertilisation is an essential. It also produces but few runners, and hence in neither direction has the reproductive facilities of its stronger and commoner brother. Its name Hautboy is a corruption of *hautbois,* for its best loved habitat is a high-wooded situation.

THE MUSK MALLOW

MALVA MOSCHATA

THE Mallows are some of our handsomest English flowers. Three varieties are to be found by our roadsides, the Common Mallow (*Malva sylvestris*), the Musk Mallow (*Malva moschata*), and the

a, *a*, calyx, fruit, etc., back view. *b*, petals. *c*, stamen. *d*, ovary with stamens and stigmas.

Dwarf Mallow (*Malva rotundifolia*), but the last named has only small and poor flowers. The Musk Mallow, whose picture is here given, is undoubtedly the most beautiful, its large rose-coloured flowers

clustering in a mass at the summit of its slender stem a couple of feet or more high. A sweet scent hangs about it; even its leaves, when touched in warm weather towards evening time, send up a fragrance as of delicate musk. Hence its name, Musk Mallow.

But it was not for their beauty that our ancestors sighed :—

> "Alas! when mallows in the garden die!"

but for their wonderful reputed healing powers. Pliny asserted with a delightful whole-heartedness, "Whosoever shall take a spoonful of the mallows shall that day be free from all the diseases that may come unto him," while Michael Drayton, writing on the virtues of plants, says :—

> "The med'cinable mallow here
> Assuaging sudden tumours;
> The jagged polypodium there
> To purge out evil humours."

It is in the leaves that the greater part of this medicinal value was supposed to lie. A certain amount of mucilage is contained in them, and this

MUSK MALLOW

is the remedial factor. Thus a decoction made by boiling the leaves either in water or in wine and water was often drunk in fevers and ague. A similar decoction was used as a hair lotion, and another, made from the whole plant, to bathe the feet in when a chill was suspected. The boiled leaves themselves were sometimes applied to painful swellings and the stings of wasps. In fact, Mallow largely took the place in olden days of linseed to-day. The fruits too—the well known "cheeses"—had a famous drink made from them by boiling them in milk, which was found very soothing in chest troubles, no doubt again because of the mucilaginous nature of the liquid.

The leaves of the Musk Mallow are of two kinds: those rising from the root which are roundish and large lobed, and those growing off from the stem, which are very much divided into delicate segments—the contrast is very marked. The flowers, however, are naturally the chief point of interest. Let us look at one just opened from the bud. Each

has a somewhat unusual calyx of two layers of green sepals. The calyx remains green and flourishing long after the rest of the flower has faded; in fact, it is still there when the fruit matures. The large pink petals (occasionally, but rarely, they are white) have bases tapering to a point, but spread triangular-wise and end in two lobes. This tapering towards their base allows the calyx to show between them so that, looking down on the flower, five green star-rays can be seen radiating from the centre, still further enhancing the beauty of the flower. Running right down the petals are a number of deep rose lines, all leading to the centre—honey guides, indeed—for at the very base is a tiny pit of honey carefully protected by over-arching hairs, and the lines end at the pit.

Within the petals notice an imposing column with a fluffy pyramid on top, the column being formed of the united stamen stalks, the pyramid of their loose anther heads. Now these anthers are somewhat different from those of most flowers we

know. In the first place, each is a single chamber, though usually an anther is two-celled. In the second place, while most anthers open by splitting lengthwise, those of the Mallow split transversely to let out the pollen. And the pollen grains are specially noticeable—not, indeed, to an unaided eye, they are too minute for that—but placed under the microscope they reveal themselves as things of real beauty, tiny balls studded all over with the tiniest of prickles. On this, the first day of the flower's life, the stamen pyramid forms a most convenient perch for insect visitors who come for honey, and who take away honey and pollen. It is the flower's day of giving; it receives nothing in exchange.

But the next day is the day of receiving. The stamens hang down withered and useless, but their place has been taken by a bunch of dark red feathery tips stretching outwards. These are the stigmas, the receptive points of the carpels, and they stand right up above the faded stamens, and to-day

they are the perch on which the insects settle. Hence an insect coming from a staminal perch will inevitably bring some of the spiky pollen balls with him and leave them on this stigma perch as he dips into the honey pits. And so the day passes. Each pollen grain sends out a tube which creeps down the long passage to the seed box, and there it merges its contents with some of the waiting immature seeds.

The flower fades, and gradually there come into existence hairy little objects which the children call "cheeses," and which lie on the green calyx as on a dish. Each "cheese" is a flattened circular collection of a number of segments (rather like the segments of a flattened orange), and each segment is a fruit; and when at length the cheese splits up and its parts are scattered each can produce a new fruit. These "cheeses" contain a considerable amount of mucilage, and are often eaten with appreciation by country children.

The patriarch Job speaks of his enemies "who

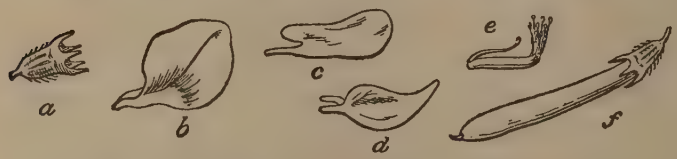
cut up mallows by the bushes, and juniper roots for their meat," but there has been considerable discussion as to what plant is intended. A certain species of Mallow, called Job's Mallow, grows in the East now, and the mucilaginous nature of the fruit and leaves causes it to this day to be used as food. But other writers have suggested that various other plants, such as salsola, come more nearly under the original Hebrew designation of the plant.

The handsome hollyhocks, which give such colour and distinction to a garden, are close relatives of the Mallow, and come to us from the Mediterranean district. Certain tree Mallows from the same region are often cultivated in our gardens. The abutilon, too, is another relative.

THE BIRD'S-FOOT TREFOIL

LOTUS CORNICULATUS

ANY place seems good enough for the gay little Bird's-Foot Trefoil. It is most accommodating in its likes and dislikes, and will make itself at home almost anywhere, on the top of a dry wall, in the deep grass by the wayside, in shady meadows,



a, calyx. *b*, standard. *c*, keel. *d*, wing. *e*, stamens. *f*, pod.

and on bare downs, down chalk pits and by sandy river beds, in all such places its crimson buds and its bright yellow flowers find a home and add a touch of brilliant colour. It may vary slightly in details to suit its different situations, but the varia-

BIRD'S-FOOT TREFOIL

tions are small and unimportant, and throughout the whole summer its flowers may be found in abundance. It is no climber, and never rises far above the ground, though sometimes its slender stems are lifted by growing among other plants, but in bare places it trails along with flowers and fruits resting on the earth. It owes much of its attractiveness to the fact that its flowers are gathered into clusters on the ends of often long stalks, and this massing together makes considerable patches of colour.

Each individual flower is of the papilionaceous, or butterfly, type, with a large, upstanding petal (the standard), two side petals (the wings), and two smaller petals, which are below, and which together form the "keel." This type is common to the whole family of which the Bird's-Foot Trefoil is a member; nevertheless, this plant has a certain amount of distinction in the way in which it manages its affairs. To begin with, we must notice as a matter of importance that in it the keel and the

wings are locked together by means of a fold in each wing fitting into depressions on either side of the keel. Now before it is time for the flower bud to open—indeed, before the petals are full grown—the ten stamens are mature, and the pollen within them is all ready, so the anthers burst and discharge all their pollen into the bud, and it lies inside and at the tip of the keel. All the ten anthers now shrivel up, having no longer any purpose to serve, and five of the stamens as a whole also wither, but the five other stamens thicken at the ends where the anthers were and lie together, almost touching the pollen. It should be noticed that these stamens are joined together into a little tube at their base, and under this is hidden honey. One stamen is, however, loose, and thus a space is left through which an insect visitor can probe to the honey. The flower's machinery is now all prepared for events.

Then the flower opens and flaunts colour and scent, and presently a bee comes—perhaps a hive-

bee, perhaps a humble-bee—and, hovering over the bright little flowers, settles on one, but not on its big standard petal. He finds his most convenient alighting place is to seat himself astride on the sort of saddle formed by the wings. But his weight is considerable, so he presses on his seat, and as the wings are interlocked with the keel he perforce presses that too. This causes the stamens at their thick ends to push the pollen just as if they were pistons, and out of the point of the keel some of the pollen comes and is shot on to the legs and body of the bee. It is a regular pumping out of pollen, and a very curious process. Directly the bee flies off again the tension is released, and the wings and keel return to their normal positions. It has been found that pollen can be pumped out half a dozen times if the pumping be done only moderately. This pumping apparatus is only found in a few flowers of the lotus family, and nowhere outside it.

The stigma, ready to receive pollen, is pushed out by the same impetus as the pollen. It strikes

the bee, and so gets touched at once by any pollen from another flower that the bee may have on its body. But in this plant, as in many others, if it cannot obtain pollen from another plant, its own pollen will fertilise it, so that practically it is always able to set seed.

When the flower fades a very characteristic change takes place, and one to which it owes its name, for the cluster of flowers transforms itself into something resembling a bird's foot with outstretched claws. This is due to each of the flowers forming a thin pod which dries and darkens, and the several pods stick out just as claws do. Sometimes the remains of the style persist at the tip of each pod and look rather like nails, thus adding to the bird's foot resemblance. Later the pods slit and each half twists into a loose coil, and in this way the seeds are not only set free but expelled some small distance.

Besides "Bird's-Foot Trefoil," the plant is also called "Devil's Claws," "Cat's Claws," "Cat's

Clover," "Devil's Fingers," "Cuckoo's Stockings," "Crowfoot," "Lamb's Toe," and "Lady's Slipper," all with reference to its curious seed pod. "Cat's Clover" has probably a double reference in it, first to the clover-like leaf and then to the seed pods. Other names of the countryside for it are "Butter and Eggs," "Eggs and Bacon," "Butter Jags," and "Cheesecake," doubtless because of the colour of its flowers. "Jack-jump-about" and "Tommy Tottles" are other quaint synonyms with no obvious meaning. "Ground Honeysuckle" is a name due to its trailing habit.

The leaves of the so-called "Trefoil" are only trefoil at first sight. If we examine more closely one of these compound leaves, we shall find that there is another and larger pair of leaflets down by the base of the leaf stalk, so there are five leaflets, not three, while there are also two extremely minute leaves, sometimes called stipules, below.

But perhaps the greatest point of interest in this plant centres in that part which is not seen—

the root. If we dig this up—it is very strong, and penetrates deeply into the ground, so that this is not altogether an easy task—and wash it free from the clinging soil, we can see that on it are a number of irregular thickenings about the size of beads. Now these nodules are not merely some accidental irregularity in the formation, they are actually the homes of certain colonies of bacteria. These bacteria are in a kind of partnership with the plant (it is rather suggestive of the fable of the Lion and the Mouse). They are sheltered within its root tissues and feed upon it, but at the same time they have the power of taking in nitrogen that exists free in the air, and passing it on to the plant in a form that it can use. The lotus and the plants belonging to its family are, therefore, able to do what very few indeed of the green plants can do, and that is, get the nitrogen that is so vital to them out of the air where it is in abundance—indeed the air is, roughly, four-fifths nitrogen. All other green plants have to get it from the soil in a

solution of some compound, and hence the expensive manures to which farmers have recourse, because the plants impoverish the soil and they must replace the nitrogen that has been taken out. But the lotus, and other leguminous plants with nodules like it, actually enrich the soil through the bacteria colonies to which they give a home. We cannot yet explain how it is that some plants have formed this alliance with these tiny organisms and others have not—that is a problem yet awaiting solution—but it is because of this partnership that so many plants of this family, such as peas and beans, are useful to man in providing him with the nitrogenous foods he needs as flesh-formers.

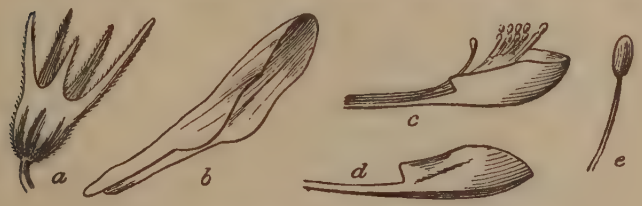
At times the Bird's-Foot Trefoil has an unpleasant experience. A small gnat comes and lays its eggs in one or more of the flower buds. These eggs quickly hatch, and the larvæ therefrom take up their abode in the cavities of the ovary where the seeds should be, and the whole bud changes through their presence. The corolla never opens, but remains

like a cap, though the calyx swells and becomes inflated, and a gall is formed which looks rather like a bulb. Naturally, the presence of these gnats entirely destroys all chance of the flower fulfilling its proper functions or developing normally, so it is entirely lost to the plant. The name of this destroying gall-gnat is *Cecidomyia Loti.*

RED CLOVER

TRIFOLIUM PRATENSE

THE Red Clover and the humble-bee are partners, but with this distinction: to the Red Clover the visits of the humble-bee are a necessity —no other visitor can take its place; to the



a, calyx. *b*, standard. *c*, keel. *d*, wing. *e*, stamen.

humble-bee the Red Clover is only one—though a specially desirable one—among a host of flowers that offer it hospitality. So the partnership is rather one-sided. It is quite a number of years ago now since Charles Darwin first pointed out

this partnership to us. He took a hundred heads of Red Clover, and covered them up so that no bees could possibly get to them when they flowered, and he took another hundred heads and left them uncovered so that bees had full access. The bees buzzed among the uncovered ones sucking their honey and passing from flower to flower, but, of course, the covered ones had no visitors. When it was seed-time he examined both sets of plants, and upon the bee-visited ones he found a great number of seeds—about 2,700 indeed—but upon the unvisited ones there was not a single seed to be seen. Therefore we discover that if the bees did not visit the Clover one year there would be no Clover at all the next. In Australia the farmers, remembering how valuable a part of the English crops Red Clover is, imported seed, and had a fine crop the first year, but as they had forgotten to import the humble-bee with it there were no seeds for a second crop. So then they sent for bees, and all went happily ever after.

RED CLOVER

A regular "house-that-Jack-built" sort of sequence has been pointed out in this connection. The number of humble-bees is very dependent upon the number of field-mice, because the mice eat the nests and combs and destroy the bees; hence the more mice the fewer bees. But again near villages and towns there are many cats, and these catch and eat mice. Hence the more cats, the fewer mice and the more bees, and, lastly, the better crops of Clover. Anyone who has watched the bees humming and swarming over the Clover-fields cannot fail to notice their keen appreciation. Pliny saw it many centuries ago, and happy is the bee-keeper who lives in the vicinity of Clover fields. The attraction, of course, is the honey stored within the heads; so richly stored, indeed, that it even gives the character to the flower's scent. Shakespeare, no doubt, was thinking of the Clover when he spoke of certain words as "more rich than honey stalks to sheep." As one watches both bees and sheep luxuriating in Clover-fields, one can understand how the saying

"to live in clover" as a synonym for ease and pleasure, has arisen.

The Clover, like the daisy and the scabious, has adopted the plan of collecting its little insignificant flowers into bunches, and so making them attractive in the aggregate. Over a hundred little flowers often go to make up a Clover-head, and each of these flowers is after the butterfly pattern, such as we have already seen in the bird's-foot trefoil, though each is so small that one does not at first suspect it. There is the usual irregular corolla, the ten stamens, and the seed-pod in the centre. The corolla tube is so very long in proportion to its width that only a very long proboscis, such as a humble-bee possesses, can get down to the honey and bring about fertilisation, and that is why these bees are a necessity to it. Many butterflies, indeed, hover over a Clover-field, and with their long tongues perhaps get at some of the honey, but it is probable that from their shape they can do nothing in return for the flower's bounty. The lower flowers of the

head open first, and the youngest flowers are at the top in the centre of the rounded head. When the flowers are over the petals do not fall off as is usually the case, but turn brown and dry up, enfolding the pod between them. When the heads ultimately fall to pieces, these dried petal-envelopes undoubtedly help to make the fruit more easily dispersed. When the minute pod is quite ripe its top drops off, and the single seed is set free. Finally, we must not omit to notice two curious little scaly leaves at the base of each flower-head.

The leaves of a Clover, composed of three leaflets each quaintly marked with a white streak, are well known. Every night these leaflets close; the two side ones come together, and the top one folds down over them like a roof; and every morning with the daylight the upper one raises itself and the side ones move apart, and the typical leaf is again before us. In Christendom this leaf of three leaflets has always been held to hold a mystic allusion to the Trinity, and hence the Clover has been

counted among the sacred plants. The evil that witches work, said an ancient writer, could be averted "by the holy trefoil's charm." All sorts of legends have gathered around it, especially around that rather rare sport, a four-leaved Clover.

"If you find an even ash leaf or a four-leaved clover,
You are bound to find your true love ere the day is over,"

runs the old couplet. Even to dream of it was an omen of long life and prosperity. Similar virtues are attributed to a two-leaved Clover in some counties. On the other hand, say the Germans, if you happen to be carrying a four-leaved Clover in your pocket on Christmas Eve you can see the witches and spirits. But perhaps this is sly sarcasm as Christmas Eve is a most unlikely season for one to be carrying about a Clover-leaf. Gerard attributes medicinal value to it, for, says he, the Meadow Clover pounded with honey "takes away the pin and web in the eies, ceasing the pain and the inflamation thereof if it be strained and dropped therein."

Red Clover

The name Clover comes to us from the Anglo-Saxon, *Clæfre*. The club of Hercules had a head shaped like a Clover-leaf, and hence the Clover-leaf as the mark of the suit in a pack of playing cards is known as a club.

Not only are Clover crops most valuable in themselves as forage, but they are also valuable in that they actually enrich the land on which they grow owing to the colonies of bacteria that exist in the little nodules on their roots. How this happens has already been explained in the chapter on the bird's-foot trefoil, both plants being members of the great family of the *Leguminosæ*.

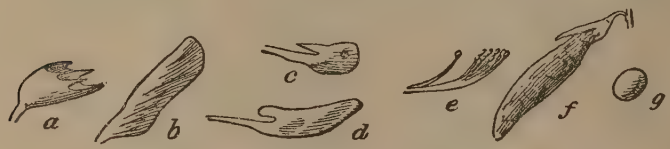
This plant flourishes everywhere throughout Europe.

THE TUFTED VETCH

VICIA CRACCA

"A vetch will go through
The bottom of an old shoe,"

SAYS an old country adage, alluding to the hardiness and persistency of the Vetches, and of these plants the Tufted Vetch is undoubtedly the most beautiful. Its slender stems, too weak to sup-



a, calyx. *b*, standard. *c*, keel. *d*, wing. *e*, stamens. *f*, pod. *g*, seed.

port themselves, grow to a height of four to six feet, trailing over the hedgerows, where their large clusters of purple-blue flowers make gay streaks of colour two or three inches long. The leaves, too, are

TUFTED VETCH

delicate and graceful accompaniments to the scheme of beauty; each consists of three tendrils and some twenty leaflets arranged in pairs, the terminal and last pair of leaflets on every leaf being changed into tendrils to enable the stem to cling to the hedge twigs as it pushes its way upwards.

The plant is found all over Europe, in North America, and in parts of Asia, and wherever it grows it is one of the greatest ornaments of the hedgerow in July, August, and early September. Indeed, it has often been suggested that it should be definitely grown over garden hedges for their greater adornment, especially as its fragility and delicacy prevent it working the havoc that a bindweed or a honeysuckle does. This trailing habit has two important consequences. On the one hand it is a source of protection to the plant and prevents its extermination by chance cattle; for, growing on the hedge-side, it gains the protection of the sharp spines of the hawthorn and the prickles of the brambles so that its natural foes are kept

at bay. On the other hand, it debars its cultivation and its consequent increase by man because, though it is most nutritious and productive, it cannot be grown profitably as a crop, since every plant would require to be supported, and the labour involved in providing sticks would far outweigh the profit that would accrue from it as fodder. Therefore lucernes and the like, though actually not quite so valuable in themselves, are preferred by the farmer.

The Vetches, like the clover and the trefoil, have an alliance with certain bacteria which dwell in nodules on their roots and enable them to take nitrogen direct from that vast reservoir, the atmosphere, instead of having to depend on compounds that may be in the soil. Thus they become very rich in nitrogenous matter, and can even hand on some to the soil, so that, unlike all other plants which have not formed this alliance, they enrich instead of impoverish the land on which they grow. It is now believed that different forms of bacteria

are found on the different species of plants; thus, that there is a clover bacterium, a vetch bacterium, a pea bacterium, and so on. In any case, we do not seem able to transplant the bacteria from one to another with satisfactory results.

When we turn to look more closely at the long leaves we find there is one special point of interest to be noted. At the base of each leaf—not leaflet—are two little green leafy structures, each rather like half an arrow-head. Insignificant and almost always over-looked as they are, they yet play an important part in guarding the treasure of the plant, for they stand out and keep off the ants and other small insects which would otherwise creep up the stem and try to steal the honey. In the Common Vetch—*Vicia sativa*—these stipules, as they are called, have a black spot on them, which actually pours out honey while the flowers are in bloom, so that the ants creeping up to the flowers eat this and are satisfied, and do not trouble the blossoms. Thus, says Grant Allen, does the plant offer a little

stem-honey as blackmail in order to protect the really valuable and necessary honey that the flowers contain.

The Vetches belong to the *Leguminosæ* order, and have the usual butterfly-pattern flowers of the family which have been already minutely described. In the bird's-foot trefoil we saw that the keel was interlocked with each wing at one point; in the Tufted Vetch this interlocking takes place at two points, so that the connection is doubly secured. There is the usual stamen tube, formed here by nine stamens, one being left loose to allow of a gap for the convenience of the insects. At the base is the honey. The brilliant appearance of the flower-clusters, together with their sweet honey and scent, give an irresistible invitation which is accepted by bees in great numbers. They settle on the flowers, the interlocking gives to their weight, they secure the honey, and the pollen is poured out on them, incidentally they dust the stigma, and away they fly; but, delicate as are the flowers, the

elasticity of their parts is so excellent that directly the weight is taken off they spring back to their original positions, and the interlocking is once more effected. The resulting fruit of the flower is a pod, as is usual in a flower of this type. In this case it contains some half-dozen seeds, and is about an inch long.

But there is one enemy that the Vetch flower cannot guard against, and that is a burglar bee. Very often—too often, indeed—certain bumble-bees (*Bombus terrestris*) visit the flowers in a surreptitious and underhand manner. Instead of alighting on the petals and opening them in the legitimate way, they settle on the stalk and bore a hole through the base of the flower. Through this they insert their proboscis and suck out the honey, then they retire, and, of course, neither bring nor carry away pollen for the flower. One close observer of these bees says that the same bee always behaves in the same fashion—that is to say, he is always either an honest and legitimate visitor, or a con-

stant and deliberate burglar. We cannot explain why this should be, or what first leads a bee into these evil ways, unless, indeed, a taint of vice exists even among such humble members of the animal world as they are.

THE ROSE-BAY WILLOW HERB

EPILOBIUM ANGUSTIFOLIUM

"A GOODLY and stately plant, having leaves like the greatest willow or ozier, . . . garnished with brave flowers of great beautie, consisting of four leaves apiece of an orient purple

a, sepals or calyx. *b*, petals. *c*, stamen. *d*, fruit.

colour." So wrote the herbalist Gerard three hundred years ago. It seems to have been rarer in his time, for he only mentions it as growing "in Yorkshire, in a place called the Hooke, . . .

from whence I had these plants, which doe grow in my garden, very goodly to behold, for the decking up of houses and gardens." But now it is not infrequent, and the present writer well recollects a certain cliff-like hillside in Gloucestershire where the blossoms of this plant made a perfect revel of ruddy colour; while recently, in the heart of London, self-sown, it covered a piece of waste land near the Strand as with a crimson mantle. Yet we still tend to class it with such flowers as the columbine and the foxglove, which, though natives of our country, find an honoured place in our gardens, and are perhaps better known to us there than in their natural haunts.

The Willow Herb owes its Latin name of *Epilobium* to two Greek words—*epi* and *lobos*—which recall the fact that the flowers stand upon the tops of long, thin, pod-like seed vessels, which seed vessels uninstructed people are apt to take for only rather thick flower stems, so close is the resemblance. For much the same reason it has earned

ROSE-BAY WILLOW HERB

the old English country name of "Son-before-the-Father," because, as Lyte explained long ago, "the long husks in which the seede is contained do come forth and waxe great before that the floure openeth." Other country names, such as "Codlins and Cream" and "Apple Pie," have been given because the young shoots, when bruised, give out an odour that imagination stretches to resemble those of the dainties referred to. Its most usual name of Willow Herb (or its corruption, Withy Herb) is due to the resemblance between the leaves and those of willow trees which Gerard remarked; it is also known as Rose Bay and French Willow. The specific Latin name—*angustifolium*—also, of course, refers to the narrow leaves.

There are no fewer than nine Willow Herbs natives of Great Britain, several of which so very closely resemble each other that they can scarcely be said to be separate varieties. The Rose-bay Willow Herb—a picture of which is here given—is the handsomest. It grows about four feet high, and

has larger and deeper-coloured flowers than its nearest ally, the Greater Willow Herb (*E. hirsutum*). It prefers moist banks and open woods, but is not wedded to them. Kerner states that it "only develops its beautiful flowers in sunny situations accessible to hive- and humble-bees. The more intense the sunlight, the more vividly are the flowers coloured. Should trees grow up and densely overshadow the Willow Herb, the flowers atrophy before opening and fall away from the axes as small withered structures." And he continues: "Whilst the richly flowering plants form only short offshoots, these shaded plants produce long subterranean runners, which seek to penetrate to a distance out of the area of shade."

The flowers are particularly worth notice, and have quite a varied two-days' life. They are massed together in pyramid form on the tops of long, unbranched stems, and each appears to have a stalk of moderate length, though really half at least of this is the pod. If we examine a flower

pyramid from the apex downwards we shall be able to trace in the flowers of different ages the successive phases through which a single flower passes in its life. At the top of the pyramid are many unopened magenta buds. The flowers nearest the buds are but newly opened—to be precise, they opened between six and seven o'clock that very morning—and they have eight stamens standing up in a bunch and forming an arch or dome over the honey hidden at the base of the flower. They are covered with somewhat sticky pollen, which, if placed under the microscope, looks somewhat like a broken net or tattered fringe, for each grain is fastened to others by viscid threads, and this viscidity makes it particularly likely to adhere to insects. Out of the very centre of the flower, but curving always unobtrusively to one side, arises a reddish club-like object, scarcely noticeable at this stage. And the bees which are buzzing about the flowers find it no hindrance on their way to the honey.

Lower down we have flowers which opened the previous day, and in which a change has taken place. The once inconspicuous club-like body—the style—has straightened itself, and is now the centre of the flower and the centre of action too. Its end is opened out, and presents a white cross of great distinctness—the stigma—which confronts the honey-seekers and perforce receives any pollen they may carry as they push by to get to the nectar below. This cross is best seen in these flowers in the earlier part of the day; if we look later in the day a rather remarkable thing has happened. Their life is now drawing to a close, so they end it by an act which ensures the success of their plans. The arms of the cross, which at first stood out high above the stamens, curl backwards toward them; the stamens straighten themselves to meet the approaching arms; the stalk-like ovary curves a little so that the flowers droop a trifle, and as the result of these united efforts the remnants of its own pollen are transferred to its own stigma, and thus at the

eleventh hour self-fertilisation is effected in case the bees have not already done it. The Willow Herb is certainly wonderfully complete in its arrangements.

Below these second-day flowers are a few withered ones, but these quickly give way to many long projecting pods, off which the dead flower-heads have fallen as cleanly as though they had been cut with a knife. At the bottom of the pyramid, if sufficiently late in the flowering season, are pods which have split into four long strands. These stretch wide apart and disclose a mass of silky white hairs. In these hairs are embedded the very tiny seeds, a few hairs being attached to the top of each seed. Every puff of wind scatters them broadcast over the neighbourhood, and thus the Willow Herb keeps its place in the scheme of nature. And thus, too, on a single stem can we see the whole life of the flower laid bare before us at a glance.

It may here be remarked that the particular purplish-red hue of the Willow Herb is a colour by

which bees are especially attracted and which they visit eagerly. (We see much the same colour in the foxglove, another bee-flower.) That this is so is all the more curious when we remember that scarlet and cinnamon-reds are not liked by them. Kerner found that when Willow Herbs and scarlet geraniums were flowering side by side in his garden, butterflies visited both indiscriminately, but bees always flew past the scarlet flowers with indifference, and turned only to the purple flowers of the Willow Herb. If by any chance a flowering stem gets pressed to the ground just before flowering, the stem will make an elbow-like bend just below the flowers, and bring them quickly again into an erect position, lowly indeed of necessity, but the correct one in which to receive their insect visitors.

THE MEADOW CRANE'S-BILL

GERANIUM PRATENSE

THERE is an old Eastern legend that the geranium owes its origin to Mahomet. The prophet had occasion once to wash his shirt, and he threw it to dry over some mallows on a bank.

a, calyx. *b*, petals. *c*, stamen. *d*, stamens surrounding ovary, style and stigma

They were so sensible of the honour of supporting his garment that their flowers blushed deeply, and the leaves to a lesser degree; and when he removed the dry shirt geraniums instead of mallows

stood before him. The legend does not condescend to explain how the change in detail in the flower's structure was effected, for mallows and geraniums are nowadays widely divergent, as we shall show in these pages.

The Meadow Geranium, the subject of our sketch, is almost exotic in beauty, and differs considerably in colour from the rest of its family. Its handsome flowers, often as big as a penny, are of a beautiful blue-purple colour, and as it stands in a mass at the corner of some corn or clover-field in the brilliant July sunshine, it has been well said that "an enchanted haze of palest blue, an indescribable atmospheric azure film, formed, as it were, from its own substance, seems resting over it." The leaves, too, take their share in the beauty of the whole. Unusually large, perhaps even half a foot in diameter, they are deeply cut into five lobes, and these lobes again into many segments. Their stalks are long and spread conspicuously before us, and when autumn comes and they tinge with rich

MEADOW CRANE'S-BILL

crimson, they are indeed a fitting complement to the lovely flowers.

This plant grows chiefly in meadows, as its name implies; less frequently in woods and by the lane sides. It is more often to be found in the south of Great Britain than in the north; it is rarely to be seen in Ireland. It is a tall plant, three to four feet high, and a perennial, and its stems, like the stems of most of its family, are swollen at the nodes.

The main flower stalks are long and branch into two slighter stalks, which each carries a single flower. These flower stalks are hairy, the hairs all pointing downwards, and thus small insects find it impossible to creep up them with ulterior designs on the honey above. Every flower has a two-days' life before it; it opens early in the morning and closes for good in the evening of the next day, and during this time it keeps its face towards the sun. The petals, which are often very fleeting, have a collection of hairs on their lower part. The use of these hairs is

an open question. It has been suggested, firstly, that they are intended, like the hairs on the stem, to keep off insect thieves from the honey which lies just below at the base of the flower; secondly, that they are provided as a roof to prevent rain from watering and spoiling the honey. No doubt they serve both purposes.

Within the petals are ten stamens which, when the flower first opens, are all lying down upon the petals. In the centre the style stands as a thick column. When the flower-bud bursts, five of the stamens immediately begin to raise themselves round the style and one after another their anthers open, and they pour out their pollen. They then fall back somewhat, while the remaining five rise and perform the same action. As soon as the anthers are empty they begin to wither, and in a few hours they fall off, leaving behind only ten long filaments like needles. Thus does the first day pass. The second day's advent sees the central column outspreading into five stigmas which stand

out ray-like. Yesterday, when the insects came, attracted by the brilliant colour and honey, they carried away pollen; to-day they leave it behind from some other flowers. Cross-fertilisation is absolutely essential in this plant. Unlike many other plants, it appears to make no alternative or supplementary arrangements, and, if the one fail, then perforce progeny fails too. No doubt it relies on its exceptional brilliancy to attract.

Then the fruits form, and these are distinctive enough to have given the whole group of plants its name, for if turned through a right angle when mature they bear a superficial resemblance to a crane's head with its long bill, *Geranos* being the Greek for "a crane" and the English name being merely a translation of it. This fancied resemblance was seen by Dioscorides nearly two thousand years ago, and it is to him that we are indebted for the suggestion. But it is in the mechanism of the fruit that the great interest lies, for it belongs to the class that we call "explosive fruits"—that

is, fruits that throw their seeds to some considerable distance from the parent plant. It is worth while to notice how this is done by the geranium. A central axis grows from the flower stalk up through the styles. The capsule, which is made up of five parts, each containing a seed, is drawn out with it, the part containing the seeds being the reputed bird's head and the drawn-out part the long beak. Presently, when all is ready for the seed dispersal, there is great tension, and suddenly the parts of the capsule give at the base and coil outwards with force. For a moment the seeds are retained in their place by some hairs, but as the coil flies upwards they are shot out as if from a catapult. On some warm autumn day it is quite pretty to watch this "slinging" going on in a group of these plants. We can see it, perhaps, more at our leisure and convenience if we gather a stem with ripe fruit upon it before the dew is off, and place it upright in a vase in the sun. It will soon dry, and then, one after another, the fruit will snap

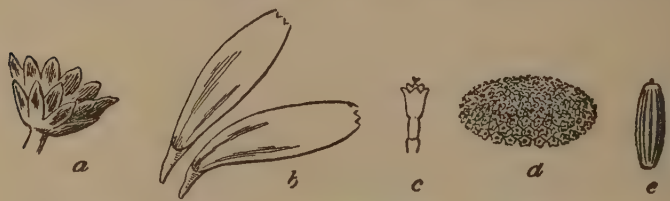
and crackle, the lower part curl sharply up, and the seeds fly out. All the wild geraniums have this method of dispersing their seeds.

There are no fewer than fourteen species of geranium growing wild in Great Britain of which the little Herb Robert is perhaps the best known. The garden geraniums so widely used as bedding-out plants are not really geraniums in the strict sense of the term but pelargoniums, another branch of the same family, hailing from the Cape.

THE OX-EYE DAISY

CHRYSANTHEMUM LEUCANTHEMUM

THE Daisy is a standing example of the advantages of judicious co-operation. It is one of a very large family of plants which have elected to go in for quantity in combination rather than



a, involucre of bracts. *b*, strap-shaped florets. *c*, a tubular floret. *d*, centre of bloom consisting of rings of tubular florets. *e*, fruit.

for quality in individuals. They have chosen to develop a large number of quite insignificant flowers, and have massed them together in tens and even in hundreds as heads on single stalks, with the

OX-EYE DAISY

result that most conspicuous blooms have been formed, and, though we habitually speak of a daisy flower or the flower of a marigold, we ought really to say a daisy flower-head, or the head of flowers in a marigold.

And this plan of co-operation has been an unqualified success. The family of composite flowers —the *Compositæ*—is spread all over the globe, and boasts of not fewer than ten thousand seven hundred different varieties of plants, being by far the largest flowering plant family we have, and included within its borders are our commonest plants such as the daisy and the dandelion. The Ox-eye or Moon Daisy is one of its handsomest members. It is to be found throughout Europe and Russian Asia, and it flowers throughout the summer in pastures and on banks, especially favouring railway embankments. The ancients dedicated it to Artemis, the goddess of women, and it was supposed to be useful in diseases peculiar to the sex. In later Christian days it was transferred to St. Mary Magdalen, and

called Maudelyne or Maudlin Wort after her. In Somersetshire there is an old tradition connecting it in some way with the Thunder God, and hence it is sometimes spoken of there as the "Dun Daisy." "Butter Daisy" and "Horse Daisy" (because of its size), are other names it bears.

Now the little individual flowers of this great *Compositæ* family are of two kinds, both of which have their petals all joined together, but in one kind they are joined in a row so as to form a narrow strap-shaped corolla, and in the other they are joined into a tube. The dandelion flower-head is entirely made up of the strap-shaped flowers, the groundsel bloom is wholly composed of tubular flowers, but the flower-head of the daisy and of its big brother, the Ox-Eye Daisy, have both kinds of flowers in their composition. The tubular flowers are massed together to the number of two and three hundred on the flattened stalk-end to form the yellow cushion-like centre, and the strap-shaped flowers, to the number of perhaps thirty, stand out

as a ring of white rays from the edge of the flattened stalk-end and enclose the yellow florets like a halo.

In this arrangement the spirit of co-operation is seen prettily exemplified. Obviously the handsome white florets cost the plant more to produce than the same number of little yellow florets would, but placed as they are they are not only attractive in themselves but form the basis of attraction for the numerous insignificant florets. Thus, instead of each flower having to provide its own attractive petals, as is usually the case outside this family, here twenty-nine ray florets do all the work for the two or three hundred flowers massed in the head.

Again, just as a great business house cuts down expenses, so the Daisy economises in this floral community. Not all the flowers are perfect flowers, containing stamens and seed-box; only in the central florets of the disc are these both found; the ray florets, gay as they are, have nothing in them but a seed-box with a not particularly well developed

style. We therefore say the ray florets are female flowers, and the disc florets hermaphrodite—*i.e.* both male and female.

And now let us see what rules govern this community. As soon as the bud unfolds the ray florets are mature, and at the base of each long ray a minute forked stigma stands expectantly. Meanwhile the outer ring of the yellow disc florets are opening, their five tiny stamens have their heads all joined together so as to form a miniature chimney, and the style, a short column, stands low down in their centre. The anthers open on the inside and the pollen falls within their ring on to the style; but now the style begins to grow, its top opens out like a brush, and as it lengthens it sweeps the pollen before it until it rests on the top of the "chimney." There it takes very little to tilt over and fall on to the styles of the adjacent circle of ray florets, while the brush-like stigma opens out and waits in its turn. And day by day two or three rings of disc florets go through the same performance, so that in

a daisy several days old we see the outermost rings in the disc with fading stigmas, the next few rings have styles erect and expectant; within these, again, are two or three rings with little masses of pollen perched upon them just swept out, and yet closer to the centre are unopened tubular florets, less and less formed as one works to the very heart of the bloom. These various stages are done on so miniature a scale in the daisy, and even in the larger Ox-Eye Daisy, that they can only be seen with a lens, but if one takes a sunflower all these stages can well be observed on its great brown disc.

Small as are the florets, there is plenty of honey secreted in the community, so there is no lack of insect visitors, particularly small flies, which crawl about over the whole head. And it is obvious that these insects cause the florets to be fertilised both by pollen from adjacent rows on the same head and by pollen which they bring on their bodies from other blooms. Hence we get in the same flower-head both cross and self-fertilisation, the cross-

fertilisation no doubt helping to maintain the vigour of the stock and the self-fertilisation ensuring abundance of seeds. Having regard to the amazing success of this family, its vitality and prevalence, it seems a safe inference, as Mr. Step points out, that "it is the happy mean between continual self-fertilisation and exclusive cross-fertilisation that pays best."

When the little dry fruits form they lie on the disc, but lightly attached, and as the long stems are swayed by the wind they are shot off in various directions.

Behind each flower-head one must not omit to notice the ring of green sheathing bracts. These not only protect and support the bloom, but doubtless prevent insects trying to bite their way to the honey from below. They, as well as the rest of the plant, are permeated with an acrid juice, so that it is generally obnoxious to insects; indeed, we are assured that the Ox-Eye Daisy is "a certain remedy against fleas."

The Ox-Eye Daisy

Luther Burbank in America has recently been experimenting with this plant. He crossed and intercrossed this Daisy of fine flowers and straight, tall stem with the American Field Daisy, so hardy and prolific, and these again with the Japanese Daisy of dazzling whiteness; and after producing 100,000 seeds and selecting over a period of eight years, he has produced the Shasta Daisy—an ideal flower, with, it is claimed, the virtues of all three and the defects of none.

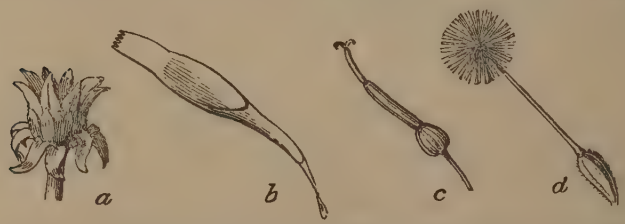
THE DANDELION

TARAXACUM DENS LEONIS

THE Dandelion, that—

> "Dear common flower that grow'st beside the way,
> Fringing the dusty road with harmless gold,"

of the American poet Lowell, is not a flower at all,



a, involucre of bracts. *b*, corolla of a floret. *c*, stamens (anthers united) surrounding style and stigma. *d*, fruit.

but a wonderful community of perhaps some two hundred members, and though it may be "common," in the sense of being plentiful, it is common in no other sense, but of rare and special interest from many points of view.

DANDELION

Our forefathers, indeed, had a much higher opinion of it in a general way than we have, though we know far more about the intricate working of its arrangements than they did. To them it was medicine, vegetable, and salad, and greatly esteemed for all, but especially for the first named. Dandelion tea was then a panacea for many ills, such as fevers, liver troubles, and for those who were "drawing to a consumption," and it is doubtless true that it has considerable value as a tonic, while as a "complexion drink" many have been found to recommend it.

The slightly acrid leaves, if bleached after the fashion of endive, make an excellent salad, a dish that, long forgotten, is now coming to remembrance. As a "green" it has never quite gone out of favour, and country people still cook and eat the tender leaves in the spring when other vegetables are scarce. Dandelion beer is a rustic fermented drink familiar to many. The thick tap root of the Dandelion has often replaced coffee beans for "coffee" making.

If washed whole and then ground it is said to be almost indistinguishable from the genuine article, and, indeed, it is claimed to be an improvement on an inferior coffee, which is so often an adulterated product. There are even found enthusiasts who say that Dandelion coffee is superior in every case in that it does not cause wakefulness, and so can be drunk by those to whom real coffee is anathema. In fact, so many are the uses of the Dandelion, that once, when Minorca was suffering from famine through the depredations of locusts, the inhabitants were able to eke out an existence for a time by the aid of the Dandelion plants that abounded in the island.

The Dandelion is at home in all parts of the north temperate zone; so plentiful, indeed, is it, that farmers find it everywhere a troublesome weed and their one anxiety is to get rid of it

To a botanist, however, each of the individual parts of the plant has some special measure of interest. To the thick tap root, acrid and almost

black on the outside, we have already referred. From this rootstock the long jagged leaves rise directly and radiate from it, forming a rosette, and we notice that each leaf is grooved and so constructed that all the rain that falls upon it is conducted straight to the centre of the rosette, and hence to the root, just as the spouting of a building leads the rain to a cistern. Thus the root is always kept well watered. If it were not for this the plant would be parched, for the leaves considerably shelter the ground around.

The margin of each leaf is cut into great jagged teeth, either upright or pointing somewhat backwards, and these teeth are themselves cut here and there into lesser teeth. It is this somewhat fanciful resemblance to the canine teeth of a lion that gives the plant its most familiar name of Dandelion (*Dent de Lion*), and its Latin name *Dens leonis*.

The tawny blooms are borne singly on hollow stems. Vivid in colour at all times, the orange becomes especially intense under the strong sun-

light of high Alpine situations. Their structure throws the Dandelion into a class with the daisy and other composite flowers, and, as we have already stated in treating of the daisy, each bloom is wholly made up of the same kind of strap-like florets that compose the rays of the daisy, while there are not any of those tubular florets that form the daisy's centre. These blooms are very sensitive to weather conditions. In fine weather all the parts are outstretched, but directly rain threatens the whole head closes up at once. So, too, does it close against the dews of night. By five o'clock in the evening it has prepared itself for its night's "sleep," to awake at the moderate hour of seven o'clock in the morning. But as this opening and closing is largely dependent upon the intensity of the light the time differs somewhat in different latitudes and at different seasons. Kerner found that the Dandelion opened about an hour later at Innsbruck than at Upsala in Sweden, evidently because there the sun rose later than in the more northern latitude.

At the base of each flower-head is a ring of narrow green bracts—the involucre. Some of these stand up to support and guard the florets, some, however, hang down to form a barricade against such small insects as might crawl up the stem and injure the bloom. All the florets that make up the head are alike in structure. There is in each the orange-coloured strap formed of five petals joined side by side, and showing their number in the five little teeth at the top. This strap rolls into a tube lower down which rests on the single-chambered ovary containing a single ovule. In the tube is a copious supply of honey which more than half fills it. Round the tube is a ring of hairs, this being the form that the calyx takes, and later these hairs play an important part in the flower's affairs.

Rising out of the tube is a structure composed of a central column, round which the five anthers of the stamens form a ring, for the anthers are all joined together, though the filaments which support them are distinct one from another. As in the case

of the daisy the anthers open on their inner surfaces and pour their pollen into the tube; its fall into the depths is prevented by the top of the short column which forms the floor of the circular chamber. Then the column begins to grow, and this causes the "floor" to rise up through the tube and sweep all before it. Soon it emerges at the top, tipping out the pollen; still it grows and presently, right above the stamens, opens into two arms.

Many little flies come crawling over the Dandelion to drink the lavishly supplied honey, and as they crawl they smear first themselves, and then the outstretched arms, with the pollen that lies loose on the top of the anthers. A careful watch was once set to find out precisely what visitors the Dandelion entertained, and it was discovered that no fewer than ninety-three different kinds of insects were in the habit of frequenting it. It is noteworthy that if by chance a floret remains unfertilised by insects it can at the last moment fertilise itself.

Now all the members of the community do not

act at the same time. It will be noticed that they are arranged in rings and that the outermost rings come to maturity first, and then the movement spreads inwards until the very heart of the disc is reached. When the whole head has matured all the florets close up again within the green sheathing bracts that lie beneath, and the bloom returns very much to the appearance it had in the bud. Its shape is somewhat reminiscent of the snout of a pig, hence in some districts country-folk call the Dandelion "Swine's Snout."

And now we say that the Dandelion bloom is dead! But it is by no means dead. Inside the "snout" all sorts of changes are going on. The base of the calyx, for instance, is growing rapidly and carrying up the ring of hairs. These are drying fast and turning white. The orange petals, it is true, are withering, and presently they are pushed off in a bunch, but between the leaves of the green envelope we get a hint of a silvery structure forming within. Then one fine day, aided by sunshine and a little

breeze, there is a sudden transformation scene, and the "Swine's Snout" becomes a beautiful gossamer ball made up of dozens and dozens of aeronauts —the seeds—each carrying aloft a parachute of silver hairs and ready for flight the moment the wind gives the signal. This ball is the "clock" of the country child; and as he puffs at it—one, two, three—he tells the time of day, some of the fliers releasing their grip at every puff until the last, most stubborn one, has gone to join the others in their flight on the summer breeze, and when this happens, that puff is the sought hour of the day. Thus do we get yet another "aspect name"—"The Clock"—for our plant.

But when all have flown and only the receptacle is left, bare, white, speckled, and surrounded by mere drooping remnants of the sheathing bracts, we see the origin of yet a fourth aspect name which once was common, namely, "Priest's Crown." It hails from the Middle Ages, and in its apt comparison to the shaven head of priest or monk recalls

the days when the tonsured head was a familiar sight of the country lanes. All the country names of plants which refer to "Our Lady," that is to the Virgin Mary—*e.g.* lady's smock, lady's taper (mullein), lady's bower (clematis)—and to monks and priests—*e.g.* monkshood, friar's cowl (wild arum)—are a direct heritage from the far back past to be dated to pre-Reformation days.

If we follow one of our aeronauts we find it dancing along sometimes high, sometimes low. Perhaps it sticks for a time on a tree or bush, but eventually it comes to the ground; either the wind fails, or the rain draggles the parachute so that further flight is impossible; but if it is lucky enough to escape buildings and water, and fall on suitable ground, its little pointed seed pushes gradually into the earth, aided thereto by minute barbs round its top, and there it germinates, and there a new generation has its day.

BLACK KNAPWEED

CENTAUREA NIGRA

TOUGHNESS and hardness are the leading characteristics of the Knapweed. Two of its common country names, "Iron-weed" and "Hard-head," testify to these qualities, the "iron" or

a, involucre of fringed bracts. *b*, an outer sterile floret. *c*, a perfect floret.

"toughness" lying in the sinewy stems and branches, and the "hardness" having particular reference to the globular mass of green bracts which forms the base of each flower-head. Its

BLACK KNAPWEED

even more familiar name of Knapweed also applies, though not at first obviously, to this same solid globe—with a special emphasis, perhaps, on the shape—for Knapweed is a corruption of Knopweed, and "knop" is an old English word for a hard, round mass, such as we now call a "knob." The word knop in this sense is used on various occasions in the Authorised Version of the Bible. Thus in the directions for making the golden candlestick for the tabernacle it was laid down that "their knops and their branches shall be of the same: all of it shall be one beaten work of pure gold." Also we are told that round Solomon's molten sea there were "knops compassing it," and these "knops" were in two rows, ten in a cubit.

The "knops" of the flowers are worth a moment's scrutiny. If we dissect one we find it is built up of scale upon scale, closely overlapping like tiles upon a roof. Each scale has a lower green portion more or less solid, and an upper fringed part which is black, or almost so. This fringe is a marked

feature, and its colour accounts for the plant being known as the Black Knapweed, *Centaurea nigra*, for, through the overlapping on to the green, the whole "involucre," as it is termed by botanists, looks dark, and each flower community is placed on a black pedestal. The generic name, *Centaurea*, recalls an old legend that the Centaur Chiron, famed for his knowledge of the medicinal values of plants, discovered that this plant, or one of its close relatives, had power to heal wounds.

The Centaurea belongs to the same order as the daisy and dandelion, and the flowers that arise out of the involucre show the usual characteristics of the family; but whereas in the daisy they are of two forms, tubular and strap-like, in the dandelion and Knapweed they are only of one form, though in the dandelion all are strap-shaped, in the Knapweed all are tubular. Also the five teeth of the petals, almost invisible in the daisy and very minute in the dandelion, are here drawn out to a considerable length, so that the flower-head is not nearly

so stiff, and individual florets have a prettiness and delicacy that we miss in the daisy and dandelion. Sometimes all the florets are alike; at other times the outer ring has petals which are emphasised and trumpet-shaped, but then these more showy florets are merely dummies containing neither stamens nor carpels, and only intended to be ornamental and to call attention to the whole. So far as insects are concerned—and, after all, they are the visitors desired—this plan is very successful. Müller found forty-eight different species of insects visiting them at one time or another.

When we look into the smaller central florets we find the usual arrangement in this family of five stamens, whose heads are all joined together into a ring round a style which is shorter than they are, so that there is the circular chamber open above, with the top of the style for floor and the inner side of the anthers for walls. Just below the top of the style is a ring of hairs forming a brush. Into this chamber the anthers open, and the powdery pollen eventually falls.

So far this arrangement is precisely that of the daisy and the dandelion, but here a striking divergence occurs in the plan of action. In the two plants just mentioned the style grows rapidly up through the tube, pushing the pollen before it; in the Knapweed the length of the style is constant, but the stamens are sensitive—"irritable," the botanists say—and the moment they are touched by anything their filaments contract all at once and down shoot the anther walls, the little brush below the top of the stigma carefully sweeping off any stray pollen as they slip by. This dramatic disappearance of the walls of the chamber naturally leaves the pollen all exposed on the top of the style.

Now this touch is usually only given by the feet or proboscis of some insect settling or crawling on the flower, and hence the pollen is not laid bare until the very opportunity occurs of getting it carried away.

A little consideration shows us that there is a deep underlying reason for this plan. However

heavy the rain or dew, the Knapweed makes no open provision against it. It does not close as the dandelion does, or hang its head as many other flowers do, but stands upright, bearing the full brunt of the weather. Therefore its pollen, if it were lying in the open, might easily be ruined and washed away. But, lying, as it does, concealed in the anthers' chamber, it is safe and dry; and when for a moment it is exposed to the weather, there is an insect at hand ready to carry it off immediately.

The stigmas of the adjacent florets are smeared with pollen by the crawling insects, but if by chance one escapes the stigmatic arms will later curl backwards and it will fertilise itself from any stray grains that may be lying among the hairs below. Thus all its seeds "set," and then the heads wither and finally break up, setting free many tiny light seeds, each crowned with minute bristles.

The Black Knapweed is a very common plant, and is found abundantly in meadow and hedgerow

all over Great Britain. Its two forms—the showy one with the ring of large outer florets, and the more insignificant one without them—are mere varieties of the same species; in fact, it is even asserted by some that the same plant will appear one year with showy flowers and another year with the less ornamental kind.

The leaves of the Knapweed are rough and stalkless, and clasp the stem at their base; the upper are long, narrow, and little divided, but the lower are lobed, or at any rate exhibit coarse teeth.

The plant grows from a foot to a foot and a half in height.

FOXGLOVE

THE FOXGLOVE

DIGITALIS PURPUREA

THE Foxglove is a "bee flower." Its whole existence is run on lines to meet and please the honey bee, and it has staked almost the very continuity of its species on the visits of this insect.

a, calyx. *b*, petals. *c*, stamens, showing their two positions. *d*, ovary, with style and stigma.

Therefore its tall and stately spikes of flowers are at their best in those sunny midsummer days when bees are at their busiest. Let us watch, then, some morning early, a Foxglove growing on hillside or hedgerow and see how bee and flower work in together.

And, while we wait, let us look more closely at the handsome spike. Its flowers hang droopingly one below the other, and always from one side of the stem—namely, on that side to which bee visitors can most conveniently approach. No Foxglove would be so foolish as to face its flowers towards the bank or even towards a wood instead of towards an adjacent meadow, where the bees would naturally forgather. At the top of the spike tiny green buds huddle together; below the buds are larger, and out of each protrudes an inflated bag. As our glance travels downwards this bag increases, flower by flower, until it may be an inch in length, and becomes pinker and pinker, but still is tightly closed, though a gentle pinch will reveal the existence of a mouth about to open. The flowers below this are open, and we can peep within the cave of one. Its floor is light in colour and covered with a curious spotting of red and lemon—"eye spots," so called; and near the mouth stand up long velvety hairs. This floor protrudes a little;

it has, in fact, been pushed forward to make an alighting platform for the bee. The ceiling of the cave is pink and unspotted; but along it, and, indeed, fastened to it in the lower part, we can detect five white lines running. We must slit up a flower gently before we can make out that four of these are stalks of stamens, two long and two short, and the remaining one is the style, rising from the top of the seed-box. At the top of each stamen are two tiny oval boxes lying transversely one below the other, so with the two pairs of stamens there are two rows of four oval boxes each, and the central column runs up between them.

Take a lower flower still, and peep in. Here the two top pairs of oval boxes are splitting along their length, and out of them is pouring the finest sulphur-coloured dust—the pollen. They have altered their position, too, and are now lying lengthwise instead of transversely. The column from the seed-box is pushing forwards and dividing a little at the top. In a still lower flower all the pollen-boxes have

placed themselves lengthwise, opened, and poured out their contents; the gay corolla is loosening, and very shortly it will slip off like a petticoat, carrying the four columns and the emptied boxes with it; and if we look yet once more lower on the flower stalk, we shall see where this has already happened, and the little seed-cases are lying green and bare, though still protected by the green sepals.

And now let us watch a visiting bee. He alights on the conveniently pushed-out lip of one of the lowest flowers on the spike—he always begins at the bottom and works upwards—and walks straight into the cave, the little hairs at the entrance in nowise inconveniencing him as they would a smaller insect. He disappears completely within it and clambers up, his burly body well filling it, and his back rubbing on the roof where the pollen boxes lie. His attention, however, is wholly given to getting at the honey which he knows lies in a ring round the seed-box right at the very top of the drooping flower. When he has sipped it he backs

out of the flower and goes on to one of the other flowers above, where the same routine happens, and then on to another and another, always upwards, until he comes to the yet tightly-closed bags, when he flies gaily off to an adjacent spike. Again he plunges into the lowest flowers where the seed-box column is forward and cleft at the top, and his pollen-covered back brushes it well and some of the dust sticks to it. *That* is the whole point; that flower is now satisfied, and its contrivances, its form, its habit of life are now justified. It has received the fertilising touch through the agency of a bee. Two or three other flowers will thus be fertilised, and then he visits one whose hour is not yet come, and whose style is not yet cleft to receive the pollen. Still, he will collect more honey and more pollen, and he flies away, both his purpose and that of the flowers perfectly fulfilled.

But the Foxglove, though it stakes much upon the bees, does not risk quite its all upon them, and when its corolla slips away, petticoat fashion, it

drags the pollen boxes over the cleft style. If it has been fertilised already no harm is done; if it has not, well at any rate it is now, and so the seeds will set in any case. The life of each flower—that is, from the time the bud opens to the time it slips its corolla—is about six days.

As the autumn draws on the seed-boxes become brown and dry, and split from apex to base and shake out their seeds. It is an almost inconceivable fact, that a single Foxglove plant will provide from one to two million seeds to ensure a posterity.

But though the Foxglove specially arranges for the visits of the honey bee, and for the honey bee alone, there are numbers of other small insects that are very partial to the drooping thimble-like flowers. On any cold evening a number of tiny insects may be found taking refuge from cold and wet there; and it is a curious fact that the temperature within the flowers is always a trifle higher than that without, and this little difference in tempera-

ture may mean all the difference between life and death to some of the small flies.

The normal life of a Foxglove plant is two seasons—*i.e.* it is a biennial—but sometimes the roots persist and throw up flowers for several seasons. Its leaves are at the base of the flower stem and are covered with small hairs, but are not nearly so hairy as those of its close relative, the mullein. Though there is only one species of Foxglove native to this country, the plant has many close relatives, chief among them being the snapdragon, the toad-flax, the veronicas, the little eyebright, the aforesaid mullein, and various other plants, such as the yellow rattle and cow-wheat, whose chief characteristic is that they are thieves, and filch their nourishment from their neighbours.

The exact derivation of the name Foxglove is a little dubious. The "fox" should probably be "folks"—*i.e.* fairies—for the plant has always been associated with the fairy folk; thus Hartley Coleridge speaks of elves who "sweetly nestle in

the Foxglove's bells." This makes the meaning "Fairies' Gloves" a more comprehensible allusion than Fox's Gloves. But a far better suggestion still is that it is derived from "Folk's gleown," "gleown" meaning a peal of bells, the spikes of flowers well lending themselves to the suggestion of fairy music.

"Lady's Thimble" and "Dead Men's Thimbles" are other country names. Its Latin name, *Digitalis*, with the same "thimble" allusion, was given it by the well-known herbalist, Dr. Fuchs, who lived in the reign of King James the First, and whose memory we keep green in the name of the Fuchsia.

THE TOAD-FLAX

LINARIA VULGARIS

IN perhaps no other plant of the hedgerows is there such quaint gaiety as in the Toad-flax, and in the late summer it is one of the most brilliant spots of colour we have. The curiousness of its appear-

a, calyx. *b*, looking under upper lip of corolla. *c*, section through corolla showing spur. *d*, stamens. *e*, fruit.

ance accounts for the many fancies the country folk have about it, and for the many names by which they know it. They say that the orange and primrose flower-spikes look like so many miniature toads jumping out at the passer-by, and, indeed, there is

a strong resemblance between the mouth of the flower and the wide mouth of a toad; while if a flower be picked and laid on its back it is really remarkably like a young frog emerging from the tadpole stage, tail and all. Thus does it get the "toad" in its name. The general resemblance of this plant in spring-time to a flax plant accounts for the "flax" and also for another of its country names, "Flaxweed." "Its beautiful spikes of butter-coloured cornucopias, apparently holding the yolk of a diminutive Spanish egg," as it is somewhere described, are responsible for its name of "Butter-and-Eggs," and hence by association "Eggs-and-Bacon," though it is not apparent where the bacon comes in. "Patten-and-Clogs" is a name not so easy to justify, nor yet its American one of "Brideweed." "Gallwort," by which it is known in Sussex, refers to a remedy for ailing poultry made by infusing the leaves. Its Latin name, *Linaria*, is another acknowledgment of its flax-like aspect. The study of "aspect"

TOAD-FLAX

names is by no means to be despised. There is always some justification for these country terms, and a consideration of them often brings to remembrance points of view, old traditions, and old-world remedies which would otherwise have passed into the limbo of forgotten things.

Even before the flowers appear the plant possesses a great charm in the tall slender stem, ringed with multitudes of pale grass-like leaves, whose bluish bloom is a welcome relief in the green hedge-side. The leaves contain a rather disagreeable acrid juice, so that they are distasteful to cattle, and left untouched by them. As they possess no smell—at any rate, not until they are bruised—it is difficult to understand how animals realise they are not to be eaten, unless, indeed, the animals' sense of smell is keener than our own, but apparently they never attempt to bite them.

The flowers have much in them to interest us. In the first place each is a complete box, quaintly shaped and decorated, no doubt, but still com-

pletely closed, and it never opens until a strong bee comes along and forces its entrance. Watch a bee approaching a spike of flowers. Each flower that faces him presents to him an orange platform (called the "palate," from its resemblance to the palate of a mouth), which "palate" has two spreading primrose lobes. Above it is a projecting roof like the roof of a portico; behind the palate a long, pointed spur stretches away for nearly an inch. The bee hovers over a flower, and then makes straight for the orange platform; the colour is specially designed to attract him. This platform works on hinges, so that it promptly falls a little beneath his weight, and the flower-box is now open to him. Inside he is confronted with a cave, along the floor of which are two upstanding ridges of orange hairs, and a track between them leads straight to the mouth of a deeper recess still—the spur. Above this recess is the egg-shaped seed-casket; on either side of it two columns rise and run along the roof, while still two other shorter columns rise behind it. A fifth

column stands on the centre of the seed-case. Between the bases of the two longer columns is a narrow passage, a culvert indeed, for in a cushion behind honey is manufactured, and it trickles through this culvert and is stored in the hollow spur.

Into this cave, then, the bee plunges and is half lost, his head fits well into the cavity below the seed-box, his proboscis goes down the spur, and he drinks his fill as from a well. Meanwhile, his back is being well coated by the pollen from the stamens which run along the roof, the whole arrangements at this point being similar to those already described in the foxglove, for the Toad-flax and the foxglove are both members of the same family and very closely allied. To the snapdragon the alliance is even closer; in both there is the same closed flower with an entrance working on hinges, the only difference being that the Toad-flax possesses a spur, and the snapdragon does not. It is computed that a humble-bee can easily take the honey from ten of

these spurred flowers in a minute. Sometimes a curious phenomenon happens. Instead of only one spur being produced, each of the five petals whose union builds up the toad-like corolla forms one, and the flower becomes of regular though almost unrecognisable shape. Botanists speak of this phenomenon as "peloria"—*i.e.* a monster. An old country custom is to infuse the flowers in milk and put the infusion about when flies are troublesome, as it attracts and destroys them.

The fruit of the Toad-flax is a little capsule, dry and rounded. It opens at its tip when ripe, and the many minute seeds are thrown out by the swaying of the stems. If we look at one of these under a lens we see it is an almost exact replica on a very minute scale of the fruit of an elm; there is the same flattened seed lying in the centre of a circular wing, the whole forming a small disc. This wing helps to convey the seed to some little distance, at least, from its parent.

The Toad-flax is very prolific. It has been

introduced into North America—probably with grain, as it is often found among the corn—and, like many another European plant immigrant, it tends to run wild there to vexatious extremes.

THE WHITE DEAD NETTLE

LAMIUM ALBUM

THE Dead Nettle is a clear case of familiarity breeding contempt. Were it a rare plant just introduced to our notice, its pairs of handsome leaves and its quaint hooded flowers, stand-

a, calyx. *b*, petals. *c*, stamen. *d*, ovary, style and stigma.

ing out so bravely in white tiers up the square stalks, would be thought by us a marvel of striking beauty and cherished in our gardens. But, instead, we see it as the commonest of plants, dirty and

WHITE DEADNETTLE

draggled in every wayside ditch, and at home on every ugly waste spot, so we think of it merely as a troublesome weed and pass it by without a second thought. And yet *Lamium album*, the "white throated," can undoubtedly claim a place among our beautiful wild flowers.

It owes its name of "Nettle" to the fact that the plant as a whole bears a strong general likeness to the stinging nettle—though the flowers are strikingly different in the two plants—and the "dead" in its name to its inability to sting in spite of the resemblance. This is not a pure coincidence, but a clever adaptation, as Lord Avebury pointed out: "It cannot be doubted that the true nettle is protected by its power of stinging, and, that being so, it is scarcely less clear that the Dead Nettle must be protected by its likeness to the other," particularly as the two species are very commonly found growing together. He points out that as those Dead Nettles in which the resemblance was strongest would naturally have the best chance of survival, so

the likeness has become closer and closer, and probably serves not only as a protection against browsing quadrupeds, but also against leaf-eating insects. There are many other country names which refer to this false suggestion of stinging power, such as the "Blind Nettle," the "Dumb" or "Dummy Nettle," and the "Deaf Nettle." A much prettier name than these is in use in some parts of the country—namely, "The White Archangel," or, more shortly, "Archangel," probably because it first came into flower about the day dedicated to the Archangel Michael —May 8th, in the old style of calendar (of course, eleven days earlier than May 8th is now). It is also known as the "Bee Nettle," because the bees are its chief visitors, and dearly love it for its sweet honey. Indeed, the honey is provided so lavishly that country children feast on it and call the flower "Suck-bottle" or "Suckie Sue."

It is most interesting to notice how especially the flower is built to encourage and utilise bee visitors—in particular, the big humble-bees. Out of

the spiky five-pointed calyx rises the white petal tube, which expands into an erection of most irregular shape, with wings, hood, and lip, reminding one of an old-fashioned pulpit with sounding board above and reading-desk below. This erection has been built up out of five petals, one having gone to form the lip, two to form the hood, and two to form the little wings. Four stamens lie in pairs along the back of the erection with heads well up under the "sounding-board hood," their dark faces turned downwards. One pair is somewhat longer than the other, so that their heads lie a little beyond those of the second pair. It has been suggested that this arrangement is to keep the pollen out of the eyes of the bees; but, at any rate, it seems to secure that the anthers lie in the best possible spot for transferring their pollen on to its back. The long column from the ovary also lies with them, and all mature together, but the stigma hangs a little out beyond the anthers. Down in the bottom of the corolla tube, as everyone knows, a rich store of honey collects.

Now watch a bee coming. He alights on the lower lip, straddling across as on a saddle. He then thrusts his proboscis down the petal tube, and if it is at least three-eighths of an inch long he finds the honey and sits sucking it up contentedly. In the meantime, in this position his dusty back exactly fits into the conformation of the corolla, so he first rubs the projecting stigma as he settles in and incidentally deposits pollen on it, and then he presses on to the stamens and gets dusted with their pollen in exchange. But observe how clever the plant is. Unless the insect visitor is a big bee, his back would not fill the cavity and neither stamens nor stigma would be touched, so the flower encourages no smaller insects to visit it, and hence places its honey in such a position that only the big humble-bees, with their long probosces, can reach it. It is not going to give its honey away for nothing! It also guards against smaller insects creeping down the tube by placing a barrier of hairs round it just above the honey. At the same

time there are certain insects which are too clever for the plant—the ground humble-bee, for instance—whose tongue is far too short to reach the honey, but who, nevertheless, gets at it, thief as he is, by biting through the very wall of the white tube down by the base and then sucking away at his leisure, defrauding the legitimate visitors and paying nothing in return for the sweets he receives. But this is not all; other little insects at times make use of the opening he has made, and they, too, come in for some of the feast after he has gone away satisfied.

When the flower fades the calyx still remains to protect the little nutlets. It is somewhat stiffened, and when the nuts are ready for dispersal any pressure upon it forces it back a little, and on the pressure being removed the nuts are shot out with considerable force. Judging by the rapid multiplication of this plant all its arrangements turn out most successfully, which is not always the case, for with plants, as well as with mice and men, the best laid schemes "gang aft a-gley."

When we turn from the flowers to the leaves we still find much to interest us, the first point being their handsome saw-like margins, and the second the curious groove on the upper side of their stems. They arise in pairs, each pair precisely at right angles to the one above and the one below, and when rain falls the surplus water trickles off the leaves and runs down the little channel in the stem to the big main stalk; there the groove is continued, and the water is conducted to the grooves of the next pair. "Now," says Kerner, "water trickling down such a groove falls precisely on that part of a lower leaf where the rain retained by the surface of that leaf is collected, and so the stream of water becomes more and more copious as it approaches the ground." Thus the Dead Nettle collects rain and conducts it to the ground just by its root, so that it is thoroughly irrigated. In fact, these groovings remind us of the spoutings on buildings, which gather all rain-water and eventually pass it on to a cistern.

The White Dead Nettle

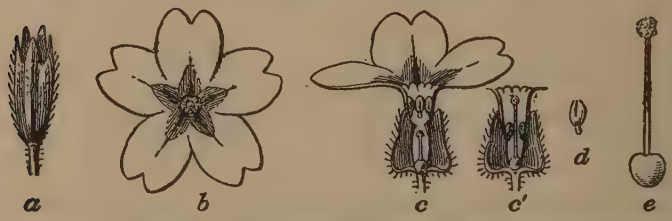
The main stalks of the Dead Nettle, and, indeed, of all its relatives, are square and hollow, and are strengthened at each corner by specially strong columns of fibres. Both stem and leaves are covered with small rough hairs, and contain certain essential oils which probably make them distasteful to cattle, even after their non-ability to sting has been discovered. Country boys have found out that they can cut the stems and make whistles out of them.

The White Dead Nettle is most industrious in its flowering. From May almost until December the blossoms can be found. It has some very close relatives—the Yellow Dead Nettle (*L. galeobdolon*) and the Red Dead Nettle (*L. purpureum*). The latter has smaller flowers, with shorter petal tubes, so that bees with shorter tongues can sup on its honey and fertilise it.

THE PRIMROSE

PRIMULA VULGARIS

THE Primrose is a flower of the poets. Its pale yellow flowers, "luikin' oot o' their leaves like wee sons o' the sun," have ever made a special appeal to the poetic mind, and again and again it



a, calyx. *b*, petals. *c*, arrangement of stamens and style in thrum-eyed flower. *c'*, arrangement of stamens and style in pin-eyed flower. *d*, stamen. *e*, ovary, style and stigma.

is apostrophised and referred to by them. Greek mythology weaves a story round it. Paralisos, son of the goddess Flora, lost his sweetheart and died of grief, but, it tells us, he lives again in "the rath (*i.e.*

PRIMROSE

early) primrose that forsaken dies." Shakespeare associates it, too, with sadness, for in *Cymbeline* he makes Arviragus say, when mourning over Imogen whom he supposes to be dead, "I'll sweeten thy sad grave; thou shalt not lack the flower that's like thy face, pale primrose, nor the azur'd harebell like thy veins, no, nor the leaf of eglantine."

Everyone knows how, in these later days, the Primrose has become the badge of a political party, just as the violet was in France many years earlier, and Primrose Day, April 19th, the zenith of the Primrose season, is a rallying day for all its adherents.

The delicate tint of its blossoms is unique among flowers, and has given us a colour name for a special tone of yellow. Old writers, however, thought of it as a special tone of green; thus Spenser speaks of the "greene primrose," and so, too, does Parkinson, writing two hundred years ago in his Herbal. It is usually taken as the representative flower of the spring. March sees it beginning to bloom; April and early May see it in full perfection in copse and

hedgerow. The Primrose, like the lesser celandine, has to prepare for its early appearance by making special provision beforehand, so each summer it not only meets its immediate needs, but lays up a store of nutriment in its thick rootstock. All the winter this store lies hidden, but when spring comes the plant awakes and calls upon it, producing therefrom leaves and flowers.

The unfolding of the Primrose leaf is really a pretty operation. The baby leaf consists simply of a stout midrib, with two little crinkled coils laid tightly along it and hidden away on its back. With the quickening warmth of the sun these gradually uncoil, and, as they do so, the face of the leaf broadens until the mature, wrinkled, veined leaf is before us. The face of the leaf shows nothing of the process of uncoiling; we must turn the leaf over to discover it, and herein it is the diametric opposite of the violet, as we have seen.

The most curious fact about the Primrose is that two different kinds of flowers characterise it, one or

other being found on a plant, never both; one kind being known as pin-eyed and the other as thrum-eyed. Now in both there is a similar green tubed calyx, and a similar corolla of pale yellow petals joined into a tube below and spreading into a disc above, but in the centre of the pin-eyed flowers there is only the green knob of the stigma, looking just like a pin's head; in the centre of the thrum-eyed flowers there are five anthers in a ring round the tube, but no central knob. If we split the two flowers down the centre with a penknife and compare them, we find that in the pin-eyed there are five anthers, like little sacs hanging on to the wall of the corolla half-way down the tube, while in the thrum-eyed at this very spot is the stigma knob that we missed from the centre of the petal disc. At the bottom of the tube, alike in both, is the seed-case, rather like an egg in shape, and round it honey is displayed.

Now it was Charles Darwin who first let us into the secret of the Primrose, and this is what he pointed out. The corolla tube is deep, the honey

lies at the bottom, and only a long-tongued insect can reach it. If he starts collecting honey on a pin-eyed flower, he gets pollen on to the middle part of his proboscis out of the anthers half-way down the tube, and as he goes from flower to flower on the same plant there is the same result every time. But if he passes to a plant with thrum-eyed flowers, then the pollen on his proboscis is just exactly in the right place to rub on the stigma, which only reaches half-way up the tube. In the meantime, his head and the base of his proboscis get pollen from the long stamens, and when, later on, he leaves that plant and returns to pin-eyed flowers, the tall stigma will get the benefit of his dusty head. It is all a matter of cross-fertilisation, and a very ingenious scheme it is that the Primrose has evolved, since necessarily only a pin-eyed flower can fertilise a thrum-eyed one, and vice versa. We have not yet been able to discover why of two apparently identical Primrose plants one bears thrum-eyed flowers and the other pin-eyed; nor can we

tell by any possible means which kind of flowers any particular young plant will produce until we have seen its flowers for the first time.

It is also worthy of notice in this connection that the pollen of the two flowers differs, the grain of that in the thrum-eyed flower being distinctly the larger, and there is a corresponding difference in the structure of the stigma surface which receives them. A moment's thought shows us why the pollen grains should be the larger in the thrum-eyed flower; they are destined to fall on the long stigma of the pin-eyed flower, and hence they must be able to put out long tubes to reach to the ovary sac far below. The other smaller pollen, destined for the shorter stigma, has only to send out a comparatively short tube to reach the waiting seeds.

Darwin believed that moths were the chief agents in the cross-fertilisation of the Primrose, and the pale unclosing flowers certainly gleam out with considerable distinctness in the dusk.

"The fireflies pricked the gloom where the meadow vapours rolled,
The cup of the primrose-bloom was brimmed with a pallid gold;
And above a single star shone virgin and faint and cold."

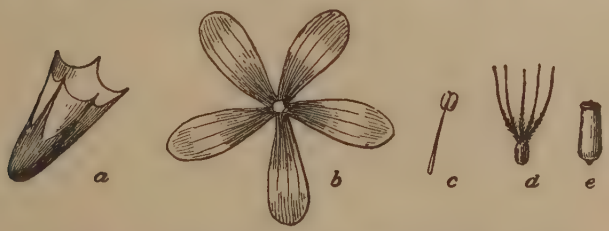
The Primrose family is remarkable for the number of hybrids it produces, and, in fact, the Primrose, cowslip, and oxlip are all thought to be different flowers of the same species, the oxlip being the connecting link, because it has flowers like the Primrose, though they are grouped on to one stem after the fashion of the cowslip.

THRIFT

THE THRIFT

ARMERIA VULGARIS

THE special point of interest about the Thrift is that it is one of those plants whose home is by the sea-shore. All round our coast, wherever there are salt marshes and mud-flats, there we find the



a, calyx. *b*, petals. *c*, stamen. *d*, ovary, with styles. *e*, fruit.

Thrift. Sometimes the flow and ebb of every tide surges round it; sometimes the spring tides wash over it, often the spray falls upon it, but still it thrives. On windy sand-hills out of touch with the

sea, or on mud wastes impregnated with salt, the tufts of thousands of Thrift plants stud the surface with refreshing greenness, and the multitude of their rose-coloured flower-heads add a touch of gaiety. Often, too, it nestles in crevices of the cliffs, softening their gauntness, and, with apparently little indeed to nourish it, it still flourishes. It is this power of living where almost every other plant would starve that has given it the name of Thrift, by which it is usually known, though it has other names as well, such as "Sea Pink" and "Sea Gilliflower." Years ago it used to be called "Ladies' Cushion"—the name has now almost died out, though it is very apt—because year by year the creeping rootstock sends up cushion-like tufts of greyish green leaves somewhat like grass. Hence the Germans call it "Sea Grass."

At times, however, we find the plant far enough away from the sea, blooming on remote mountain summits, a strange alternative to the sea-shore. It almost seems as if it might have been one of the

earliest plants of our land, and that the rush of later and perhaps more overpowering plants drove it out, as the Saxons drove out the Britons, and led it to take refuge on the sandy wastes of the sea-shore or on the bleak tops of mountains where they could not follow, but where its hardier habit and its power of adapting itself to its circumstances enabled it to thrive. Colour is lent to this supposition by the fact that if it is brought inland down among other plants in gardens it flourishes well, blossoming out, indeed, into somewhat larger and richer flowers, so obviously a milder and softer environment is quite congenial to it. Cultivation, however, has one curious effect upon it. In spite of its finer flowers it produces few or no seeds, and its propagation is effected by dividing the roots; it is just as if luxury had an enervating influence upon it.

When we turn to look more closely at the flower-heads we find that each is a cluster of twenty to

thirty little flowers. Individually they would have been inconspicuous and poor but clubbed together in this fashion they at once attract notice. At the base of the cluster are a number of pale semi-transparent scales. As we isolate the individual flowers we find they are very dainty midget blossoms. The petals and stamens pull easily away from the scaly calyx, leaving it in our hands as a delicate crystal cup, crowned by five transparent points, and tapering to a green stem. This calyx has a special part to play later, as we shall see. The five petals are rose pink, shading off to white at their pointed bases. The seed-case, which contains but one ovule, has five distinct and most fragile styles rising from it, but they can scarcely be made out by the unaided eye. Each flower secretes a modicum of honey.

But, minute as is the mechanism of each little Thrift flower, it is, nevertheless, of a certain intricacy, as Kerner specially points out. If we look into it carefully with a lens, we see that the five stamens

stand alternating with the five styles, and, moreover, that the five styles are closely covered with small papillæ, which give them a kind of velvety surface. In the earliest stages the insects visiting these flowers brush against the anthers, the five styles standing up erect and close together in the centre. A little later stamens and styles change places, the stamens standing up in the centre and the styles spreading away from the centre, so that now the latter are touched first by the honey-seeking flies. This interchange of position does much to ensure cross-fertilisation, especially as the changing is done slowly, since each flower has a life of two to three days. But if it fails to happen, then both styles and stamens wind themselves up into spirals which become closely intermingled, and thus, adds Kerner, "the velvety styles cannot fail to receive the pollen that still adheres to the anthers." The pollen grains are naturally extremely minute, but small as they are, they are nevertheless covered with a net-like sculpturing.

It is an interesting study to place pollen from different flowers under a microscope and notice how differently the grains are fashioned. Each flower has its own individually shaped and marked grains.

As the flowers die the whole head dries and becomes scaly to the touch. Then, when the wee fruits have ripened, we see the value of the beautiful cup-like scaly calyx. This has not vanished with the petals and stamens, but remains intact, and as the heads fall apart it acts as the most serviceable and daintiest parachute possible, and each little seed — there being only one in each flower — sails gaily away in the wind by its means.

The Thrift belongs to the family of the Leadworts, which, though a small one, is represented in most parts of the world. It is characteristic of its members that wherever they are they all seem to prefer the sea-shore. In Great Britain the family is known only by two *Statices*—the Sea Lavender

(*Statice limonum*) and the Rock Statice (*S. auriculæfolia*), and by two Thrifts—the Common Thrift (*Armeria vulgaris*), the subject of this article, and a mere variation of it, the Plantain Thrift (*A. plantaginea*).

THE BINDWEED

CONVOLVULUS ARVENSIS

FROM the farmer's point of view, the Bindweed is one of those unmitigated pests that are sent to afflict him, creeping up his hedges, strangling his corn, and "of no use to anybody,"

a, calyx. *b*, petals opening. *c*, petals fully opened. *d*, stamen. *e*, stamen, with ovary, style and stigmas.

so far as he can see. In North America, where it has intruded as a most unwelcome immigrant, it is filling him with absolute dismay, so more than kindly has it taken to the new country, so persistently does it cover the ground with its trailing

BINDWEED

stems. But from our point of view, the point of view of a flower-lover and a mere onlooker, it is just a pretty little plant which has evolved many ingenious devices whereby it may excel in the competition of life.

Its delicate creeping stems grow with great rapidity, and their ends may be compared to switches being slowly and continually swung in circles and twining round anything with which they may happen to come in contact. It has been found that a Bindweed stem, in favourable circumstances, will make a complete revolution in about one and three-quarter hours. Hence one can gain some conception of the rate of growth.

The leaves stand singly along the stem at very regular intervals, each shaped like an arrow-head. In the angle between the leaf stalk and the main stem the flowers arise, usually one (but occasionally two) to each leaf all up the stem. On an average stem, perhaps some two feet in length, we shall find in mid-season at the tip very young leaves, with

the minutest of flower-buds in their axils; as we go further along, the leaves and flower-buds increase in size, the leaves of all ages, the buds in all stages, until we find the flower-buds just about to open, say next day. In these the petals are folded into five pleats, the outermost part of the fold being a deep pink. The next flower or two are fully open (they opened between seven and eight o'clock that morning), and the petals have unfolded into a pale pink vase-shape, on the underside of which there are five dark pink rays which were yesterday the outer folds in the bud. Then come the flowers of yesterday, now faded; and, as the petal leaves fall back much into their early pleats, they look rather like dilapidated buds. And then come a series of stems with knobs at their tip, where the petals have fallen away; but, strangely enough, although these should by rights now go on maturing into fruits, as a rule they wither and ultimately drop off, brown and futile. Sometimes, just here and there, as if by chance, we may find a capsule about the size

of a pea containing seeds; but so rare is it that for quite a long time botanists did not credit this plant with producing seeds at all. In the light of what we shall now learn about the careful elaborateness of the flower's arrangements, this failure to come to fruition is particularly curious.

And now let us follow more closely the happenings in this flower's career after it has opened to the sun. As it unfolds the first thing that comes into sight is the two-armed stigma, the arms widely extended upwards and outwards. Below cluster the stamens, and down at the bottom of the flower are what appear to be the mouths of five tubes or pipes running downwards. (These can be seen much better in the big white flowers of the Hedge Bindweed.) Flowers with tubes like these are known as "revolver flowers," because of the fancied resemblance to the barrels of a revolver. The gentians are another example of "revolver flowers." In the Bindweed the tubes are formed by the flattened filaments of the stamens being joined to the

corolla tube and yet projecting, ridge-like, into the flower.

These tubes lead to the honey which is contained in five little sacs, one at the base of each tube. The sacs lie touching each other in a ring round the seed-box, so that if the parts of the flower be stripped away, leaving the seed-box bare, it has the appearance of an egg in an egg-cup. To get to the honey an insect has to thrust its proboscis down each tube in turn; but just over the top of every one, and exactly where he must knock it, is an anther, and as this anther opens on the outside its pollen falls on the insect as he knocks. The branching stigma makes a most admirable perch for him while he dives time after time to the honey.

Although when the bud first opens the anthers stand below the open stigma arms, yet they rapidly grow to its height and longer, and then they can pour their pollen upon it. Thus, in the earlier part of the flower's life there is the chance of cross-

fertilisation; in the later part it would seem there was a certainty of self-fertilisation. Why, then, the schemes so often miscarry and the flowers seldom set fruit is a problem; perhaps it requires some special insect not now common to be the necessary instrument, and perhaps, too, self-fertilisation is not very effective. It is quite certain it is not lack of insect visitors in general that is the cause, for all sorts pour into the open corolla, attracted by the honey and by the faint suggestion of a vanilla scent that characterises it.

This flower is one of those that fold their petals and close at night. It is also a flower sensitive to weather conditions, and always closes if rain comes on, to open again with the advent of sunshine. If this precaution be not taken, a vase-shaped flower, such as this is, runs the risk of being absolutely filled and irretrievably ruined by a sharp shower. Curiously enough, its bigger brother, the beautiful white Hedge Convolvulus, does not close in the rain, though it does at night.

But if the plant fails often to set seed, it is obvious that it has some other way of keeping its place in the scheme of Nature. It is, in fact, its roots upon which it depends chiefly for its propagation. These grow very rapidly, penetrating both deeply and widely, and year by year they send up their trailing stems even where least expected. For so deep and wide are their ramifications that it is extremely difficult to eradicate them, and any little piece left behind will surely send up shoots the following season.

The common names of this plant are numerous, most of them alluding to its creeping habit. Thus it is the "Cornbind," "Ropewind," "Withywind," "Bearbind," "Robin-run-the-Hedge," and "Jack-run-i'-the-Country" in various parts of England. In Ireland, dislike to its leading characteristic is forcibly expressed in its name of "Devil's Garters." Another name, "Hedge Bells," also alludes to its flowers. As for its country, it is almost cosmopolitan, for it is found wild throughout the whole

of Europe (except the extreme north), in China, Persia, Siberia, India, and Abyssinia, North America (where it has been introduced), and Chili.

There are three convolvuluses in our native flora, the Field, Hedge, and the Sea Convolvulus. There are also various southern species grown in our gardens, such as the *Ipomea purpurea*, with its lovely purple flowers. Another *Ipomea* gives the chemist "jalap." Within its family the convolvulus has some rather discreditable relations—namely, the dodders, for whom, as parasites and pests, little good can be said.

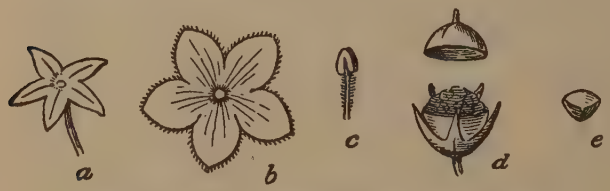
THE SCARLET PIMPERNEL

ANAGALLIS ARVENSIS

"No heart can think, no tongue can tell,
The virtues of the pimpernel."

Old English Proverb.

THE little Scarlet Pimpernel is a veritable gutter-snipe of the plant world. Its home is the roadside and the waste place, or perchance the dry,



a, calyx. *b*, petals. *c*, stamen. *d*, seed vessel. *e*, seed.

sandy edges of the corn and other fields, and under bright skies its coppery-red flowers look up almost brazenly, or play a game of hide-and-seek with us

SCARLET PIMPERNEL

when the clouds chase across the sun. One of the outcasts of the plant world—for it is a weed wherever it is found—it has yet managed to take itself by its own unaided cleverness over the greater part of the world. From Mexico to Egypt, from China to the Cape of Good Hope, from Mauritius to Russia, native in our land of Britain, there are probably few countries where it has not followed man and got a foothold, and once there it holds its own like an urchin of the street. Year by year as autumn comes it dies away utterly, but so carefully has it placed out its seeds that in the next spring time its descendants unfailingly appear to greet us in its stead.

When we look at it more closely to see how it comes to have such a hold upon life, we find that, like its celebrated namesake in the play, it is full of contrivances. In the first place, it chooses haunts where competition is not so keen—the bare, dry places of the world. True, it needs special hardiness to be able to exist in them, but this it has

acquired through centuries. Secondly, it creeps along the ground in an unobtrusive manner, in no way asserting itself, making no bid for notice. The creeping stems, perhaps a foot in length at best, have their leaves arranged in pairs; and as they lie exposed to the full sunshine there is no need for them to be furnished with stems to push their way into the light, so they are stalkless, sessile (sitting) upon the stem. They are just plain ovoid leaves, for there is no need for fancifulness in their devising, or for any cutting into segments so that light may penetrate among them. Also in whatever direction the stem may run, either along the ground or at any angle to it, the leaves always keep their faces turned up to the light.

But if simplicity is the keynote of the leaves, the flowers make up for it by possessing many ingenious devices. Each little copper-coloured flower has its rounded face made up of five petals, all joined together in a ring. Inside are five stamens, and in the centre of all is the seed-box with its green

column, the style. Now the petals are very sensitive, and they have the trick of opening and closing at the slightest provocation. They always close at night, but they close in the day too if the sky becomes at all overcast and threatens rain; in fact, we may say they are like certain people who live in a continual fear of getting damp, for they often take full precautions hurriedly when it is only a passing and harmless cloud. This unusual sensitiveness to the weather has given them their country name of "The Shepherd's (or the Poor Man's) Weather Glass," though if the shepherd always took the little flowers for a guide he would live in a perpetual state of weather-nervousness. Another point about them is that the petals are only brilliantly coloured on their upper faces, so when they are closed they disappear from view among the greenness of the leaves. Perhaps it is this coming and going, combined with their curious vivid colouring, that causes the country people of Hertfordshire to speak of them as "Adders'

Eyes." The fact is, they do not wish for insect visitors when they are closed—visitors are absolutely useless at those times—so they do not desire to be in evidence. Even in bright and fair weather the little flowers only favour the world with their gay spots of colour for a comparatively short time. They do not open in any case until between eight and nine o'clock in the morning, and they have completely gone to sleep before three o'clock in the afternoon.

Inside the petals are five stamens, each standing exactly opposite to a petal, instead of alternating, as is the rule. This leads botanists to think that once there were two rings of stamens, but that for some reason or another the earlier ring has disappeared in the course of time. This ingenious speculation is backed up by the fact that in one of the Pimpernel's close relatives one can actually see an outer ring of five tiny stamen stumps, the relics of possessions in ages past. Upon the five stamens are a number of delicate violet hairs which seem to serve as a bait to insects, taking the place perhaps

of honey, of which the Pimpernel contains none. But insect visitors are probably few and far between; occasionally, no doubt, there is some cross-fertilisation—at the outset, indeed, the plant cannot fertilise itself, so that at any rate there is a chance of it, but the plant takes no risks in the matter. When it closes on the first evening of its life its stamens are naturally pressed against the petals; and when morning comes and the flower reopens, there on the petals lie some grains of yellow pollen. When the second evening comes the little flowers inevitably close for good, and, shortly, the entire fading petal-ring falls off, but in slipping away rubs of necessity the top of the column of the seed-case, and leaves there some of the pollen that lay on its surface. Thus does the flower get fertilised, and thus does it ensure descendants.

As the autumn comes, the fruit from each flower swells and ripens. Each is the daintiest little urn full of tiny seeds, and when the day arrives in due course for the seeds to be scattered, the urn splits

all round its circumference into two halves, the upper half lifts up like a lid, and out the seeds are shaken with every movement of the wind.

In olden days this plant had a great reputation in medicinal cases, as the couplet at the head of this chapter sets forth. There was, apparently, nothing it could not cure. Pliny speaks of its value in liver complaints, and it is often believed that its generic name, *Anagallis*, is from the Greek, signifying "to laugh," because it removes the depression that follows liver troubles. (Sir William Hooper, however, refers it to Greek words meaning "to adorn again," because it is so constant in its appearance, summer by summer.) The Greeks used it for diseases of the eye, and Gerard follows them in affirming that "it helpeth them that are dim-sighted." The ancients also attributed great surgical powers to it, and in this they were followed by the herbalists of our own country, who held it "as a gallant sober herb, of a cleansing, attractive power, whereby it draweth forth thorns and splinters, and other such-

like things gotten into the flesh." Both for this purpose and for curing the bites of mad dogs they used a decoction obtained from the bruised leaves. Its reputation has survived in a limited measure to the present day, especially in dealing with diseases of the brain.

But above all things, "the Herb Pimpernel is good to prevent witchcraft, as Mother Bumby doth affirm," an old writer tells us, but Mother Bumby remains for us one of those shadowy forms once a power but now nothing but a name—a name once revered but now merely an embodiment of the crass superstitions of bygone days.

The Pimpernel flowers the whole season until late in August. A blue variety of an intense deep colour is occasionally found in Great Britain, and more commonly in central and southern Europe. A number of scientific experiments have been made on these blue and red Pimpernels by Darwin, Henslow and others. Professor Henslow found that of the offspring of the blue some had red and some

blue petals; while Darwin discovered that by crossing the red and blue some of the offspring were red, some blue, and some an intermediate colour. It would seem that the recently appreciated Laws of Mendel on Heredity would apply here.

HAIRBELL

THE HAIRBELL

CAMPANULA ROTUNDIFOLIA

AS the "Bluebell of Scotland," this plant has found an honoured place in the verses of

a, calyx. *b*, petals. *c*, stamen. *d*, stamens round ovary, style and stigma.

countless Scotch poets, and every Scotsman feels that bound up with the love of his country is

> "The heather brown an' the wild bluebell
> That wave on the muirland bare."

A wordy war once waged as to whether this plant or the wild hyacinth was the true Bluebell of Scotland and of the poets, but the evidence is over-

whelming in favour of the Campanula. Sir Walter Scott certainly leaves no room for doubt, for in describing Ellen in "The Lady of the Lake" he says:—

> "A foot more light, a step more true,
> Ne'er from the heath flower dash'd the dew;
> E'en the slight hare-bell raised its head,
> Elastic from her airy tread."

Now this reference exactly fits our Campanula, while we cannot by any stretch of the imagination think of the thick juicy stem of its rival, the wild hyacinth, being either "slight" or "elastic." Originally the name was written "Hairbell," in appropriate allusion to the delicate flower-bells drooping on their hair-like stems; but in the uncertain orthography of our ancestors it became the meaningless Harebell, and it is still often so spelt, though we are tending to return to the truer spelling. Old English names for this plant are "Ladies' Thimble" and "Witches' Thimble." The generic designation of *Campanula* refers, of course, to its bell-shaped petals; while its specific name, *rotundifolia*—round-

leaved—was given to it by Linnæus, and at first sight it seems peculiarly inappropriate to the extremely narrow line-like leaves that grace the stem beneath the flowers. But nevertheless the name is apt, for the leaves that arise from the root, which are the first to appear in the spring, are rounded and quite unlike the later stem leaves, and it was these that Linnæus saw towards the end of winter when, as professor at Upsala, he constantly passed them growing by the steps of the University. They have usually withered and gone by the time the flowers come, so that they are largely unknown.

The bright blue flowers of the Hairbell, as common on the uplands as the daisies in the plains, are some of the most beautiful we have, and they are to be found from about the middle of June until right on into the autumn; June 18th is given as about their earliest date and November 26th as the latest. The flowers hang droopingly, and perhaps of all Campanulas best deserve the name of "bell-flowers"—"Fairy Bells," the children call

them—as their dainty sky-blue blossoms quiver in the breeze. They show up gaily on the heaths and hillsides where the sheep nibble the herbage to its closest, and they owe their immunity from the animals' attentions to the fact that through their tissues there runs an acrid, unpalatable juice.

The petals were once five in number, but now they are almost entirely united, only their tips being left free, pattern-like, round the edge of the bell. In the centre of the bell and at the top is the seed-case, and, hanging from it like a clapper, is the style with club-shaped head, the whole style being thickly covered with hairs, which hairs play a most important part in the Hairbell's arrangements. Round the seed-box hang five stamens, whose filaments broaden out near the top of the bell so as to form a low-arched chamber, and within this the honey is stored. This chamber is worth special search by a flower-lover, for its presence is rarely realised.

When the bud first opens the position of affairs is that the heads of the five stamens are all closely

pressed against the hairy column; very soon these open and their pollen falls out and lodges among the hairs, and there it lies securely, instead of dropping out of the flower as it would otherwise have done owing to its hanging position. The empty stamens now wither and fall away from the style. Now comes the second stage, and with it, presumably, a bee after the honey. He flies to the mouth of the bell, the honey he knows is within at the top, so the obvious thing to do (and he does it) is to clasp the pollen-coated clapper, and by its aid clamber up to the honey and steady himself by it as he sucks. But this inevitably means that his under surface gets thoroughly dusted, and he flies away with the pollen grains thickly adhering to him. Other bees follow his example—one particular kind of bee, *Cilissa hemorrhoidalis*, goes nowhere except to the Hairbell—and they all, swinging in the bell, take their toll of honey and pollen. They are bound to keep by the pollen-coated style, because the flower has cunningly placed long hairs on the inside of the

beautiful blue petals, and these irritate the bee if he tries to creep up their walls.

The third stage in the flower's arrangements is rapidly reached. The style lengthens, its thickened head splits into three divisions which spread out and receive the bee literally with open arms, and take their toll in turn of the pollen he brings. But if they should be disappointed of a visitor as the hours pass they curl backwards and touch their own dusty stamens, and hence by their own pollen, if not by their neighbour's, they set their seeds. By the way, it may be noticed that under the microscope the pollen grains are seen to be covered all over with sharp prickles which no doubt help to keep them among the hairs. The pendent position of the flowers keeps both pollen and honey absolutely protected from rain.

But this pendent position does more than shelter the plant's own particular possessions. In common with all hanging bell-flowers, the Hairbell is a refuge at night-time for many little flies who must creep

into some shelter out of the cold and the damp, and who find the inside of drooping flowers both drier and warmer than the outside air. They may feed a little on the pollen; it is possible that at times they may accidentally transfer pollen from one flower to another, but, on the whole, they neither benefit nor injure their flower refuge.

The seed-box is divided into three compartments, in each of which there grow a number of ovules—seeds-to-be. When the flowers fade this seed-box increases in size and gradually becomes hard and brown, and marked by stout ribs. It, too, like the flower, is pendent on its stalk. Finally, the thinner tissues give way between the ribs and openings appear, through which, by the kind offices of the wind, the seeds are flung.

Although we commonly see the Hairbell with blue flowers, yet at times it has white ones, when the French call it the "Nun of the Fields" (*La Religieuse des Champs*). In a meadow sometimes one and sometimes the other colour will predominate

(this is particularly the case in some Continental countries), and it is interesting to consider how this comes to pass. Suppose certain Hairbell seeds fall and become established in a field where there are many red flowers growing, and that the flowers of these seedlings are some white and some blue. Now among the red flowers the white Hairbells are the more conspicuous, therefore they will attract the chief attention of the bee visitors and stand the best chance of being fertilised; hence the following year the white Hairbells will predominate and eventually they will be in the great majority. If, on the other hand, there are chiefly yellow and not red flowers in the meadow, then the blue Hairbell will be the greater contrast and most sought after, and the meadow will finally come, in course of time, to be shared between the blue and the yellow flowers. This principle of colour-contrasts and how it acts in influencing the distribution of flowers has been very clearly pointed out by Kerner in his "Natural History of Plants."

The Hairbell

The nearest relatives of the Hairbell are Canterbury bells, the many other Campanulas, the blue and red lobelias so common as edgings to our garden beds, the goodenias of our greenhouses, and the little sheep's-bit of our pastures.

THE BEE ORCHIS

OPHRYS APIFERA

A GREEN stalk, round which fancy sees three or four big brown bees buzzing over the flowers! Such is the plant that we often meet on chalky downs and limestone districts in the eastern and

a, sepals, back. *b*, sepals, front. *c*, petals. *d*, central column (stamen and style adherent).

southern counties during the early days of summer. Not without reason is it called the Bee Orchis, for at a little distance the flowers have an unmistakable resemblance to a bee; so striking, indeed, is it that

BEE ORCHIS

one wonders if it can have any hidden meaning, a wonder that grows when we remember that Charles Darwin watched them most carefully, and never saw a bee or any other insect visit them, though he examined hundreds, nor did he ever find one that appeared to have had pollen brought to it by insect agency. This is truly remarkable in a flower of such striking form and colour. In almost every case its own pollen had fertilised its own ovules. Nevertheless, Darwin was of opinion that an occasional cross-fertilisation must take place and strengthen the strain.

A great many years ago Robert Brown, a particularly keen observer of plant life, hazarded the conjecture that this flower closely imitated bees because it did not desire them to visit it, and as bees only flit from flower to flower to drink honey and eat pollen, they would naturally pass it over if they mistook it for one of themselves. Darwin did not consider this suggestion very feasible, nor is it yet generally accepted; still, the fact remains

that nothing better has been put forward in explanation beyond the surmise that the resemblance is a pure coincidence. But this surmise also seems untenable when we find that its two nearest relatives both closely imitate insects. One, the Fly Orchis (*Ophrys muscifera*), has a flower even more like a fly than the Bee Orchis is like a bee; the other, the rare Spider Orchis (*Ophrys aranifera*), recalls a spider with more or less exactitude. Why should all the plants of this group recall different insects if it is all to no purpose? One resemblance might be a coincidence, but surely not all. The Fly Orchis, however, in contradistinction to the Bee Orchis, seems specially attractive to its prototypes, as was noticed a couple of centuries ago by John Parkinson, who, in describing the flower, says: "The neather parte of the flie (flower) is black, with a list of ashe colour crossing the backe with a show of legges, hanging at it; the natural flie seems so to be in love with it, that you shall seldome come in the heate of the daie but you shall find one sit-

ting close thereon." Indeed, the flies perform the office of cross-fertilisation for it; perhaps the bees once did this for the Bee Orchis, but now for some reason or other they pass it by, and the plant perforce must fertilise itself.

These three—the Bee, Fly, and Spider—comprise the genus *Ophrys* of our native flora, and this is part of the great family of Orchids, of which we have in England some thirty-seven different species. Now the Orchids, individual and varied as they are, have several definite characteristics; there are three sepals and three petals all coloured in their flowers, and one of the petals is marked off distinctly from the others, and is called the lip. It is this lip, with its peculiar colouring and markings, that gives the insect appearance. In the Bee Orchis it has a surface like rich brown velvet, marked by yellowish lines and spots; it is downy at the sides, smooth in the middle, with a recurved point which mimics the sting of the bee. In many of the Orchids it has a hollow spur attached, the walls of which are full

of sweet juices, but this is absent in the particular group we are now discussing. The three sepals are rather large, outspreading, and tinged with pink; there is only one perfect stamen (though rudiments of two others can be found), and this is joined to the style to form a thick column. In each of the two cells of the anther is a pear-shaped mass of pollen—the pollinia—composed of pollen grains bound one to another by elastic threads and each on a thin, weakly foot-stalk. The column towers above this stamen like a curving beak. Soon after the flower-bud opens the anther opens too, and the pollen masses within fall forward and hang dangling out. The slightest breeze swaying them causes their stalks to give, and they fall promptly on to the top of the column, and from there fertilise the immature seeds. Thus is self-fertilisation specially arranged, and cross-fertilisation apparently not catered for. The seeds of Orchids are almost dust-like, so minute are they.

The Bee Orchis is a perennial, coming up year

after year with regularity. If we look below the surface of the ground we find at the very base of the stem two fat tubers, almost round in shape. One of these is supplying the necessary nutriment for the present demands of flowers and leaves; the other is collecting for the following season, and getting thoroughly well filled up to meet the needs of the forthcoming spring, when it will be called upon to supply the material for the new leaves and flowers. The whole flower-stalk is from a foot to a foot and a half high, and the flower-spike consists of about four or five flowers, two or three being open at a time. The Bee Orchis may be found very occasionally with white flowers. There are only a few oblong leaves clustering at the base of the stalk.

The generic name *Ophrys* is said to be derived from a Greek word signifying "eyebrow," but the exact reason for this designation is not certain.

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